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VOLUME 1 NUMBER 6

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March 23, 1963

01 GENERAL

Includes: management; space law and legal matters; symposia or conferences of a broad or a general nature.

N63-12364 National Aeronautics and Space Administration, Washington, D. C.

ADDRESS BY JAMES E. WEBB, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION [AT THE] WEST SIDE ASSOCIATION OF COMMERCE OF NEW YORK, STATLER-HILTON HOTEL, NOVEMBER 14, 1962 News Release

James E. Webb Nov. 14, 1962 8 p

Some of the forces and developments throughout the United States in industry, government and the universities which have contributed to the advancement of space power in this country are traced. The Atlas and Nova boosters, Telstar communications satellite, Mariner deep space probe to Venus, Apollo spacecraft, budget allocations for the space effort, and the liquid propellant rocket engine development in relation to Atlas and Titan II are discussed. A.R.B.

N63-12365 National Aeronautics and Space Administration, Washington, D.C.

CHRONOLOGY OF MAJOR NASA LAUNCHINGS, OCTOBER 1, 1958 THROUGH SEPTEMBER 30, 1962

Robert Rosholt Oct. 1962 10 p 2 refs
(*Its* Historical Rept. 8) OTS: $1.10 ph, $0.80 mf

This chronology of major NASA launchings is intended to provide an accurate and ready historical reference. It spans NASA's first four years. It includes launchings of all vehicles larger than sounding rockets launched either by NASA or under "NASA direction" (e.g., ABMA served as launching agent for the early Jupiter C and Juno II shots, and AFBMD for the Thor-Able shots). Performance of both the launch vehicle and the payload are classified. Three categories have been used—successful (S), partially successful (P), and unsuccessful (U). These divisions are necessarily arbitrary, since many of the results cannot be neatly categorized. Also, a great deal was learned from shots which may have been classified as unsuccessful. Launch failures are considered also as payload failures, since the payload did not have a chance to function. B.J.C.

N63-12416 Naval Research Lab., Washington, D.C.

REPORT OF NRL PROGRESS

Jan. 1963 48 p refs
OTS: $1.25

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N63-12715 National Aeronautics and Space Administration, Washington, D.C.

NASA AND THE UNIVERSITIES. PRINCIPAL ADDRESSES AT THE GENERAL SESSIONS

Homer E. Newell et al [1962] 86 p 7 refs NASA-University Conf. on the Science and Technol. of Space Exploration, Chicago, Nov. 1, 1962
(NASA EP-5) GPO: $0.55

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N63-12810 Pacific Missile Range, Point Mugu, Calif.

REPAIR VERSUS REPLACEMENT: A STUDY OF EQUIPMENT MAINTENANCE

H. Gumbel and R. J. Frisbie Aug. 15, 1961 36 p 4 refs
(PMR-TM-61-12)

The present report covers the mathematical foundation for implementing a "repair versus replacement" policy which minimizes the expected total overall cost at the end of a given, stipulated time, T. The model of repair costs could be kept fairly general so that the procedure should be applicable for a very broad class of actual situations. Specifically, it was assumed that the expected cumulative cost is a convex function of time, differentiable almost everywhere in the

domain of interest. A more detailed analysis was made for the specific case where the expected total cost is parabolic. The influence of the parameter T and the effect of errors in estimating this parameter were investigated. Author

N63-12811 Pacific Missile Range, Point Mugu, Calif.
CONTRIBUTIONS TO A STUDY OF MAINTENANCE: CHARACTERIZATION OF CERTAIN REPAIR-COST PROCESSES WITH POISSON-DISTRIBUTED FAILURE INTERVALS
H. Gumbel Oct. 18, 1961 10 p 2 refs
(PMR-TM-61-19)

In developing an implementation of a "repair versus replacement policy" previously derived, a computer "gaming" study was developed. In this study, the decision maker is confronted by a stochastic process characterizing the repair intervals and the associated costs and must make appropriate decisions in light of the previously established policy and in the absence of full distributional knowledge of the process. In order to generate suitable processes in the first place and to compare the application of the policy against the theoretically correct solution, the theoretical aspects of some reasonable stochastic processes were studied and are reported herein. It is emphasized that the processes analyzed herein were chosen for convenience, and it is not implied that the present study is exhaustive of all meaningful processes which one might stipulate as underlying the actual phenomena of equipment breakdown and repair. Author

N63-12833 General Electric Co. Technical Military Planning Operation, Santa Barbara, Calif.
COST-BENEFIT ANALYSIS AS AN AID TO SYSTEM SELECTION
Harry P. Hatry [1962] 29 p 16 refs Presentation at the General Electric Systems Engineering Symp., Schenectady, N.Y., Nov. 15, 1962
(SP-201)

A method of analyzing systems is presented as an aid in the selection of a system to perform some given mission. The method considers both the cost and effectiveness criteria, jointly. The method is illustrated by the following missions: system to repair orbiting satellites; weather and reconnaissance satellites; tactical bombing aircraft; and nuclear detection system. R.C.M.

N63-12840 National Aeronautics and Space Administration, Washington, D. C.
SPACE AND THE SCIENTIFIC COMMUNITY
Arnold W. Frutkin *In* AIBS Bulletin, v. 12, no. 5, Oct. 1962 p 68-69
(See N63-12834 06-16)

More than 55 countries are now cooperating with NASA in a variety of scientific projects for the exploration of space. Cooperative programs provide opportunities for foreign scientists to participate in space research and acquired technical competence. The programs fall into several categories: launching of experiments, prepared by foreign scientists, by U.S. boosters or sounding rockets; organization of ground-based research abroad coordinated with orbiting space experiments; participation in NASA's overseas tracking and data acquisition facilities; and programs for training foreign scientists and technicians in NASA centers or American universities. M.P.G.

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes: aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc.

For related information see: 03 Aerodynamics of Wings, Rotors and Control Surfaces; and 11 Fluid Mechanics.

N63-12369 Boeing Scientific Research Labs., Seattle, Wash.
A STUDY OF THE OPTIMUM TRANSVERSAL CONTOUR OF A BODY AT HYPERSONIC SPEEDS USING DIRECT METHODS
Angelo Miele Dec. 1962 34 p 3 refs
(Flight Sciences Lab. Tech. Rept. 64; DI-82-0220)

This paper refers to a slender conical body whose length and base area are given and considers the problem of determining the transversal contour which minimizes the overall drag (sum of the pressure drag and the friction drag), under the assumption that the pressure coefficient satisfies Newton's impact law and that the friction coefficient is constant. Direct methods are employed, and the analysis is confined to a body whose cross section is either a regular polygon or is composed of a basic circle external to which are symmetric segments of a logarithmic spiral. The analysis shows that the optimum solution is governed by the friction parameter K_f, a parameter which is proportional to the ratio of the friction coefficient to the cube of the average thickness ratio of the body. Author

N63-12465 Aro, Inc., Arnold Air Force Station, Tenn.
A CALORIMETRIC INVESTIGATION OF SOME PROBLEMS ASSOCIATED WITH A LOW-DENSITY HYPERVELOCITY WIND TUNNEL
G. D. Arney, Jr., and D. E. Boylan Arnold Engineering Development Center, Feb. 1963 31 p 8 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-63-19)

Both total-calorimeter and calorimeter-probe experiments have been carried out to more adequately establish the flow properties in an arc-heated, low-density, hypervelocity wind tunnel. Total calorimeter results show that for a sufficiently long stilling chamber, total enthalpy at the throat can be accurately determined from the total pressure, mass flow rate, and sonic throat area by use of the continuity equation. Unfortunately, the physical size of the calorimeter probe as compared to the size of the test section altered the test-section flow properties so that no useful calibration data were obtained by this means. It is concluded, however, that such a probe could yield useful calibration data in a sufficiently large wind tunnel. Author

N63-12483 France. Office National d'Études et de Recherches Aéronautiques, Chatillon-sous-Bagneux
PROBLÈMES D'AÉRODYNAMIQUE INTERNE POSÉS PAR L'AVION DE TRANSPORT SUPERSONIQUE ≪MACH 2≫ (INTERNAL AERODYNAMIC PROBLEMS OF THE MACH-2 SUPERSONIC TRANSPORT AIRPLANE)
Jacques Leynaert and Jean-Marie Brasseur [1962] 9 p 2 refs In French; English summary Presented at the Fifth European Aeronautical Congress, Venice, Italy, Sept. 12-15, 1962

Results, obtained by O.N.E.R.A., based on preliminary studies on turbojet intakes and exhausts contemplated for a Mach-2 Supersonic Transport Airplane, are presented. The experimental results obtained with a two-dimensional intake show up the elements of the choice between internal and external supersonic compression. The methods of calculation used for the study of various flow-mixing processes at the turbojet exhausts are presented, and some theoretical and experimental results are compared. Author

N63-12489 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A LARGE-SCALE WIND-TUNNEL INVESTIGATION OF A WINGLESS VERTICAL TAKE-OFF AND LANDING AIRCRAFT
David G. Koenig and James A. Brady Washington, NASA, Feb. 1963 49 p 4 refs
(NASA TN D-1335) OTS: $1.25

Results of tests on the wind-tunnel ground plane system at 0° sideslip are presented for airspeeds from 20 to 70 knots and exit vane angles between 33° and 70°. These results together with previously

published results of tests at fixed ground height are combined in the present report to obtain certain conclusions concerning the performance, stability, and control of the aircraft. Author

N63-12497 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

TABULATED DATA FROM A PRESSURE-DISTRIBUTION INVESTIGATION AT MACH NUMBER 2.01 OF A 45° SWEPTBACK-WING AIRPLANE MODEL AT COMBINED ANGLES OF ATTACK AND SIDESLIP

John P. Gapcynski and Emma Jean Landrum Washington, NASA, Nov. 1958 104 p 1 ref

(NASA MEMO 10-15-58L) OTS: $9.10 ph, $3.32 mf (Declassified)

The model configuration consisted of an ogive-circular-cylinder body and a wing with 45° of sweepback at the quarter-chord line, an aspect of ratio of 4, and a taper ratio of 0.2. Data were obtained on high-, mid-, and low-wing configurations and for the body and wing alone for a range of angles of attack and yaw from 0° to 15°. The pressure coefficients are presented. Author

N63-12498 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

HEAT-TRANSFER MEASUREMENTS OF TWO WING-BODY COMBINATIONS AT 8° ANGLE OF ATTACK FROM A FLIGHT TEST FOR MACH NUMBERS TO 4.86 AND REYNOLDS NUMBERS TO 19.2×10^6

Katherine C. Speegle Washington, NASA, Dec. 1958 61 p 18 refs

(NASA MEMO 10-25-58L) OTS: $6.60 ph, $2.03 mf (Declassified)

Two models have been flown simultaneously; both bodies were ogive cylinders, one having 39° swept wings and the other 75°. Theories assuming turbulent flow underestimated the heat-transfer rates over the entire body. The effect of the wing on the body increased heating on the windward side of the body in the wing-body region and decreased heating on the leeward side. The heating of the wings was less than turbulent theory predicted. The measured pressures on the 0° ray (windward side) and on the 180° ray (leeward side) of the nose portion of the body were generally higher than those predicted by various theories. Author

N63-12499 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

AERODYNAMIC CHARACTERISTICS FOR COMBINED ANGLES OF ATTACK AND SIDESLIP OF A LOW-ASPECT-RATIO CRUCIFORM-WING MISSILE CONFIGURATION EMPLOYING VARIOUS CANARD AND TRAILING-EDGE FLAP CONTROLS AT A MACH NUMBER OF 2.01

Ross B. Robinson and M. Leroy Spearman Washington, NASA, Oct. 1958 72 p 3 refs

(NASA MEMO 10-2-58L) OTS: $7.60 ph, $2.36 mf (Declassified)

The wings were flat plates which had beveled leading and trailing edges, a leading-edge sweep of 72.9°, and a ratio of span to diameter of 3.67. Plain flaps were incorporated in the trailing edge of both horizontal wing panels. Trapezoidal canard controls of varying size were mounted near the nose of the model in the plane of the horizontal wing. Tests were made through an angle-of-attack range of about 0° to 29° at sideslip angles of 0° and 4° and through a sideslip-angle range of about 0° to a maximum of 29° at angles of attack of about 0°, 12.4°, and 24.8°. Author

N63-12501 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

AERODYNAMIC CHARACTERISTICS OF SOME FAMILIES OF BLUNT BODIES AT TRANSONIC SPEEDS

Lewis R. Fisher, Arvid L. Keith, Jr., and Joseph R. Di Camillo Washington, NASA, Nov. 1958 64 p 5 refs

(NASA MEMO 10-28-58L) OTS: $6.60 ph, $2.12 mf (Declassified)

Several families of blunt bodies having shapes that may make them suitable for use under atmospheric reentry conditions were tested to measure the static longitudinal stability and drag characteristics of such shapes at transonic speeds. The geometric variables considered were skirt length, body slope, face curvature, shoulder radius, and the deflection of a control wedge. The tests were made in the Langley transonic blowdown tunnel for Mach numbers from 0.7 to 1.3 and Reynolds numbers, based on a body dimension of 3 inches, from 2.4 to 6.0 million. Author

N63-12505 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.

APPROXIMATE SOLUTIONS FOR THE FLOW ABOUT FLAT-TOP WING-BODY CONFIGURATIONS AT HIGH SUPERSONIC AIRSPEEDS

Raymond C. Savin, Washington, NACA, Sept. 15, 1958 70 p 21 refs

(NACA RM A58F02) OTS: $6.60 ph, $2.30 mf (Declassified)

The type of configuration analyzed is a half body of revolution mounted beneath a thin wing the vertex of which is common to the body. Algebraic expressions defining the flow field about conical configurations are developed. These expressions are combined with the generalized shock-expansion method to obtain the flow about a configuration which is curved in the stream direction. Experimental pressure-distribution data for several flat-top wing-body configurations at Mach numbers from 3 to 6 are included. Author

N63-12506 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

THRUST AND PUMPING CHARACTERISTICS OF A SERIES OF EJECTOR-TYPE EXHAUST NOZZLES AT SUBSONIC AND SUPERSONIC FLIGHT SPEEDS

Donald P. Hearth and Alfred S. Valerino Washington, NACA, Nov. 17, 1954 36 p 14 refs

(NACA RM E54H19) OTS: $3.60 ph, $1.31 mf (Declassified)

Data were obtained for various ejector configurations over a pressure ratio range from 1 to 10 and secondary-to-primary weight-flow ratio to 0.36. The results indicated that the external supersonic airstream had no effect on the internal ejector performance when the secondary airflow was choked. The mass-flow discharge coefficient of the primary nozzle for the low-diameter-ratio configurations was reduced as secondary weight flow was increased. Author

N63-12508 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

PERFORMANCE CHARACTERISTICS OF SEVERAL DIVERGENT-SHROUD AIRCRAFT EJECTORS

William K. Greathouse and William T. Beale Washington, NACA, Sept. 8, 1955 46 p 24 refs

(NACA RM E55G21a) OTS: $4.60 ph, $1.58 mf (Declassified)

Ten divergent-shroud ejectors were investigated over a range of expansion area ratios and pressure ratios representative of flight Mach numbers of about 3. Variable shroud geometry is necessary for an ejector to attain near-optimum thrust performance over a typical current range of flight conditions. An ejector installation having a fixed primary nozzle could maintain near-optimum thrust if the shroud were variable from a cylindrical shape at low subsonic Mach numbers to a divergent shape at supersonic conditions. For an afterburning turbojet, a practical ejector is perhaps the conventional double-iris design modified so that the shroud could be either conical, cylindrical, or divergent in shape. Author

N63-12510 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

FULL-SCALE EVALUATION OF SOME FLAMEHOLDER DESIGN CONCEPTS FOR HIGH-INLET-VELOCITY AFTERBURNERS

William R. Prince, Wallace W. Velie, and Willis M. Braithwaite Washington, NACA, June 28, 1956 50 p 7 refs

(NACA RM E56D10) OTS: $4.60 ph, $1.70 mf (Declassified)

An investigation of a full-scale afterburner having high burner-inlet velocity was conducted to determine burner performance with several variations in burner design. Variables receiving particular attention were flameholder design and burner length. Data presented indicate that an annular two-V-gutter flameholder can operate at combustion efficiencies of 90 to 95 percent for fairly optimum burner length and pressure. Reduction in burner length and burner-inlet pressure had a considerable adverse effect on combustion efficiency. A mixer flame-holder configuration showed promise of providing further gains in combustion efficiency, especially at critical burner conditions. Author

N63-12516 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

COMPARISON OF CALCULATED AND EXPERIMENTAL TEMPERATURES AND COOLANT PRESSURE LOSSES FOR A CASCADE OF SMALL AIR-COOLED TURBINE ROTOR BLADES

Francis S. Stepka Washington, NACA, Sept. 4, 1958 26 p 13 refs (NACA RM E58E20) OTS: $2.60 ph, $0.98 mf (Declassified)

Two methods of calculating blade spanwise temperature distributions and a method of calculating cooling-air pressure loss through small (1.4-in. span, 0.7-in. chord) turbine blades are presented. The results are compared with experimental static cascade data. A calculation was also made of the cooling-air requirements, blade spanwise temperature distributions, and cooling-air pressure losses under assumed turboprop engine operating conditions of 2000° F turbine-inlet gas temperature and flight conditions of 300 knots at an altitude of 30,000 ft. The blade temperature calculations at these conditions are compared with those obtained by the extrapolation of correlated experimental data of a static cascade investigation of these blades. Author

N63-12518 National Advisory Committee for Aeronautics. High-Speed Flight Station. Edwards, Calif.

IN-FLIGHT GAINS REALIZED BY MODIFYING A TWIN SIDE-INLET INDUCTION SYSTEM

Edwin J. Saltzman Washington, NACA, Dec. 12, 1957 30 p 4 refs (NACA RM H57J09) OTS: $2.60 ph, $1.10 mf (Declassified)

The effects of modifying a twin side-inlet duct system have been recorded and analyzed over an altitude range from about 25,000 to 51,000 feet and throughout the transonic region to a Mach number of about 1.2. The modification consisted primarily of redesigning the inlet lip, increasing the cross-sectional area of the inlet and diffuser, and adding a region of duct contraction ahead of the engine. These changes greatly improved the pressure-recovery characteristics and provided a 50-percent reduction in compressor-face distortion (pressure-profile variation). Author

N63-12519 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

FORCE AND PRESSURE MEASUREMENTS ON SEVERAL CANOPY-FUSELAGE CONFIGURATIONS AT MACH NUMBERS 1.41 AND 2.01

A. Warner Robins Washington, NACA, Dec. 15, 1955 108 p 7 refs (NACA RM L55H23) OTS: $9.10 ph, $3.44 mf (Declassified)

Results are presented of an investigation in the Langley 4- by 4-foot supersonic pressure tunnel of canopy pressures and canopy-fuselage forces and moments under conditions of combined pitch and sideslip. The canopy configurations tested varied in windshield shape (flat, vee-, and round), location on the fuselage, and fineness ratio. All configurations were tested at Mach numbers of 1.41 and 2.01 and at Reynolds numbers of 1.74×10^6 and 1.44×10^6, respectively, based on fuselage major diameter. Author

N63-12520 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

SIMULATED FLIGHT INVESTIGATION OF SCALED-SPEED ELASTIC SWEPT-WING BOMBER AND FIGHTER MODELS COUPLED WING TIP TO WING TIP

Robert F. Thompson Washington, NACA, Feb. 14, 1956 44 p 6 refs (NACA RM L55J24) OTS: $4.60 ph, $1.52 mf (Declassified)

Dynamic models that included elastic simulation were used in a wind-tunnel investigation to determine the flight characteristics of a swept-wing bomber with parasite swept-wing fighters coupled at the wing tips. Emphasis was placed on determining the full-scale simulated speed at which various coupled configurations could be flown. Bomber-alone flutter speeds were also determined. Bomber rigid-body freedoms other than roll were eliminated in the flight simulation. The models were coupled wing tip to wing tip with fighter roll freedom about the tip-coupling axis. Some fighter lateral trim was provided at all test conditions by fighter ailerons and the effects of providing additional (to ailerons) fighter lateral trim moments by skewing the tip-coupling axis were also investigated. Author

N63-12522 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

PERFORMANCE OF A SUPERSONIC RAMP-TYPE SIDE INLET WITH RAM-SCOOP THROAT BLEED AND VARYING FUSELAGE BOUNDARY-LAYER REMOVAL MACH NUMBER RANGE 1.5 TO 2.0

Glenn A. Mitchell and Robert C. Campbell Washington, NACA, Jan. 17, 1957 30 p 5 refs (NACA RM E56I26) OTS: $2.60 ph, $1.10 mf (Declassified)

Provided sufficient throat bleed was employed, maximum pressure recoveries of 0.87 to 0.88 at Mach number 2.0 were obtained for a fuselage-mounted 14° ramp inlet regardless of the amount of fuselage boundary layer ingested. The addition of inlet side fairings yielded further increases in pressure recovery to 0.90 to 0.91, decreased critical drag coefficients, and increased critical mass-flow ratios. With throat bleed, peak pressure recoveries and calculated thrust-minus-drag values were comparable at two axial positions of the scoop and were highest with the greatest amount of fuselage boundary layer ingested. Author

N63-12523 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

PERFORMANCE OF VARIABLE TWO-DIMENSIONAL INLET DESIGNED FOR ENGINE-INLET MATCHING. I—PERFORMANCE AT DESIGN MACH NUMBER OF 3.07

M. A. Beheim and L. W. Gertsma Washington, NACA, Nov. 20, 1956 32 p 3 refs (NACA RM E56H23) OTS: $3.60 ph, $1.16 mf (Declassified)

The inlet was investigated with both a two-oblique-shock and an isentropic compression ramp. Provisions for a variety of bypass systems were incorporated and none decreased pressure recovery by more than about 1 percent. By utilizing throat boundary-layer control, critical pressure recoveries of 64 percent and 70 percent were obtained with the two-shock and isentropic ramps, respectively. Diffuser-exit air distortion was about 5 percent at critical operation. Theoretical cowl pressure drag was equal to about 10 percent of the net thrust of an assumed engine. Author

N63-12525 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

EFFECTS OF SECONDARY-AIR FLOW ON ANNULAR BASE FORCE OF A SUPERSONIC AIRPLANE

Donald J. Vargo Washington, NACA, Oct. 11, 1954 29 p 8 refs (NACA RM E54G28) OTS: $2.60 ph, $1.07 mf (Declassified)

The effect of emitting secondary-airflow into an annular base region was studied in the 8- by 6-foot supersonic wind tunnel at Mach numbers up to 2.0 using several fixed-geometry nozzles simulating double-iris-type configurations. At specified engine operating pressure ratios, a thrust, which increased appreciably with secondary-airflow, was generally experienced in the base region. However, unless the base-emitted air has another primary use or is taken from low-energy boundary-layer air, the penalty of taking the air aboard from the free stream is too great to be practical when compared with the thrust increases obtained. Author

N63-12533 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

INVESTIGATION OF STATIC PRESSURES AND BOUNDARY-LAYER CHARACTERISTICS ON THE FORWARD PARTS OF NINE FUSELAGES OF VARIOUS CROSS-SECTIONAL SHAPES AT M_∞ = 2.01

Lowell E. Hasel and Walter L. Kouyoumjian Washington, NACA, Jan. 21, 1957 94 p 4 refs
(NACA RM L56I13) OTS: $8.60 ph, $3.02 mf (Declassified)

An investigation has been made in the Langley 4- by 4-foot supersonic pressure tunnel at a Mach number of 2.01 and angles of attack to 15° of the static pressures and the boundary-layer characteristics on the forward parts of nine fuselages of various cross-sectional shapes. The data indicate that the boundary-layer separation is affected by cross-sectional shape and that the effects of separation on the performance of a top-mounted supersonic scoop inlet can be minimized. Author

N63-12534 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

BUFFET TESTS OF AN ATTACK-AIRPLANE MODEL WITH EMPHASIS ON ANALYSIS OF DATA FROM WIND-TUNNEL TESTS

Don D. Davis, Jr., and Dewey E. Wornom Washington, NACA, Feb. 21, 1958 57 p 16 refs
(NACA RM L57H13) OTS: $5.60 ph, $1.91 mf (Declassified)

The buffet characteristics of a 1/10-scale model of an attack airplane with a modified delta wing have been investigated at transonic speeds. The buffet intensity was reduced substantially when certain modifications were added to the model. The wind-tunnel test and analysis techniques are discussed. Author

N63-12537 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

LATERAL-CONTROL CHARACTERISTICS AND DIHEDRAL EFFECT OF A WING-BODY COMBINATION WITH A VARIABLE-INCIDENCE TRIANGULAR WING AND WING-TIP AILERONS AT A MACH NUMBER OF 1.52

Richard Scherrer and David H. Dennis Washington, NACA, Jan. 10, 1951 15 p 6 refs
(NACA RM A50H10) OTS: $1.60 ph, $0.80 mf (Declassified)

Aileron effectiveness and diheral effect were investigated for a wing-body combination having a variable-incidence triangular wing with modified half-delta tip controls. The tests were conducted at a Mach number of 1.52 and a Reynolds number of 0.82 million. The theoretical effectiveness of the ailerons was compared with the theoretical effectiveness of half-delta wing-tip ailerons, and the latter were found to be slightly more effective. The wing-body combination was laterally unstable at small angles of sideslip at the maximum wing-incidence angle tested. Author

N63-12546 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

INVESTIGATION OF A 0.6 HUB-TIP RADIUS-RATIO TRANSONIC TURBINE DESIGNED FOR SECONDARY-FLOW STUDY. III—EXPERIMENTAL PERFORMANCE WITH TWO STATOR CONFIGURATIONS DESIGNED TO ELIMINATE BLADE WAKES AND SECONDARY-FLOW EFFECTS AND CONCLUSIONS FROM ENTIRE STATOR INVESTIGATION

Harold E. Rohlik, William T. Wintucky, and Thomas P. Moffitt Washington, NACA, Sept. 17, 1957 28 p 4 refs
(NACA RM E57G08) OTS: $2.60 ph, $1.04 mf (Declassified)

A semivaneless-stator configuration turned the flow to design moment of momentum at radii greater than the rotor entrance radii, and consequently at lower velocities, and then accelerated it while mixing in a vaneless passage of decreasing flow radii. The other configuration consisted of a conventional stator space several chord lengths upstream of the rotor in order to permit mixing at high velocities. Results are presented in terms of stator pressure-loss data, overall turbine performance, and rotor-exit efficiency distribution and are compared with results of a similar investigation made with the same rotor and the conventional stator located immediately upstream of the rotor. The elimination of stator-blade wakes and loss cores was accompanied by a reduction in turbulence level that resulted in poorer rotor performance and a loss in turbine efficiency. Author

N63-12547 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

INVESTIGATION OF A 0.6 HUB-TIP RADIUS-RATIO TRANSONIC TURBINE DESIGNED FOR SECONDARY-FLOW STUDY. II—DESIGN AND EXPERIMENTAL PERFORMANCE OF TURBINE WITH LOW-VELOCITY-TURNING STATOR AND STANDARD ROTOR

Harold E. Rohlik, William T. Wintucky, and Herbert W. Scibbe Washington, NACA, July 18, 1957 29 p 4 refs
(NACA RM E57E09) OTS: $2.60 ph, $1.07 mf (Declassified)

The stator was designed to reduced secondary-flow loss cores by turning at very low velocity levels and then accelerating to transonic velocity levels by converging the end walls at constant flow angle. Effectiveness of the stator was determined with detailed surveys and turbine performance measurements. Results are presented in terms of pressure losses, boundary-layer parameters, turbine performance maps, and local efficiency distribution at the turbine exit. This stator effectively reduced the maximum loss in the loss cores from that of the standard stator but developed high boundary-layer losses and resulted in poorer turbine performance. Author

N63-12548 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

AN INVESTIGATION OF A 0.05-SCALE MODEL OF THE XSM-64A NAVAHO MISSILE AND BOOSTER AT SUPERSONIC MACH NUMBERS PART I—FORCE STUDY

James D. Church and Nancy L. Taylor Washington, NASA, Sept. 1959 311 p 1 ref
(NASA TM X-16) OTS: $19.75 ph, $9.53 mf (Declassified)

An investigation has been conducted in the Langley Unitary Plan wind tunnel of the aerodynamic loads and the static longitudinal and lateral stability of a missile-booster combination and its various components. The Reynolds number range of the test was 2.4×10^6 to 2.9×10^6. Included are some effects of various controls and separately measured loads on wing, tip aileron, rudder, booster, booster separating surface, booster fin, and booster yaw and pitch thrust chambers. Author

N63-12549 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

AN INVESTIGATION OF A 0.05-SCALE MODEL OF THE XSM-64A NAVAHO MISSILE AND BOOSTER AT SUPERSONIC MACH NUMBERS PART II—PRESSURE STUDY

James D. Church and Nancy L. Taylor Washington, NASA, Sept. 1959 137 p 1 ref

(NASA TM X-17) OTS: $10.50 ph, $4.31 mf (Declassified)

An investigation has been conducted in the high Mach number test section of the Langley Unitary Plan wind tunnel to determine the pressure distribution on a missile-booster combination. Both the missile alone and the missile-booster combination were tested. Mach number range of the test was from 2.29 to 3.22 at a Reynolds number of approximately 2.6×10^6. Author

N63-12550 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

COLD-AIR INVESTIGATION OF THREE VARIABLE-THROAT-AREA CONVERGENT-DIVERGENT NOZZLES

John E. Mc Aulay Washington, NASA, Sept. 1959 33 p 3 refs

(NASA TM X-42) OTS: $3.60 ph, $1.19 mf (Declassified)

A program has been conducted at the NASA Lewis Research Center to evaluate methods of providing thrust modulation for solid-propellant rockets. As part of this program the performance of convergent-divergent nozzles in a cold-flow rig was obtained using three methods of varying nozzle throat area. These were air injection at the nozzle throat, inserts (mechanical) at the nozzle throat, and an elliptically shaped nozzle throat in which the supersonic and subsonic parts were rotated with respect to each other. Author

N63-12551 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

EFFECTS OF WING VERTICAL LOCATION ON THE STABILITY AND CONTROL CHARACTERISTICS AT A MACH NUMBER OF 2.01 OF A CANARD AIRPLANE CONFIGURATION WITH A TRAPEZOIDAL ASPECT-RATIO-3 WING (Declassified)

Gerald V. Foster Washington, NASA, Sept. 1959 37 p 11 refs

(NASA TM X-44) OTS: $3.60 ph, $1.31 mf

The investigation was conducted in the Langley 4- by 4-foot supersonic pressure tunnel on a high-wing and low-wing canard airplane configuration. In general, decrease in wing vertical location caused a small unfavorable change in maximum trimmed lift-drag ratio for a static margin greater than 0.20 mean geometric chord. Both the high- and the low-wing configurations attained a maximum trimmed lift-drag ratio of 6.0 with a static margin of zero. The low-wing configuration had greater directional stability than the high-wing configuration at low angles of attack; however, at high angles of attack, decrease in wing vertical location adversely affected the directional stability. Author

N63-12552 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

STATIC STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE MODEL WITH TAIL SURFACES OUTBOARD OF THE WING TIPS AT A MACH NUMBER OF 2.01

Cornelius Driver and M. Leroy Spearman Washington, NASA, Sept. 1959 29 p 4 refs

(NASA TM X-47) OTS: $2.60 ph, $1.07 mf (Declassified)

The configuration investigated included two sizes of horizontal tails with tail deflection angles of 3.1°, 0°, –3.1°, and –6°. Tests were made for angles of attack from –4° to 10° at zero sideslip and for sideslip angles from –2° to 6° at angles of attack of 0° and 4°. In addition to tests of the complete model, tests were made of various combinations of component parts. The maximum trimmed value of lift-drag ratio obtained was 6.55. Author

N63-12553 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

STATIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF SEVERAL WING AND BLUNT-BODY SHAPES APPLICABLE FOR USE AS REENTRY CONFIGURATIONS AT A MACH NUMBER OF 6.8 AND ANGLES OF ATTACK UP TO 90°

Jim A. Penland and William O. Armstrong Washington, NASA, Oct. 1959 41 p 15 refs

(NASA TM X-65) OTS: $4.60 ph, $1.43 mf (Declassified)

This investigation, which was made in the Langley 11-inch hypersonic tunnel, showed that wing planform had no noticeable effect upon the lift-drag characteristics at very high angles of attack and that the maximum lift coefficient was not appreciably changed with a variation in Mach number in the high hypersonic speed range. The blunt-body shapes were found to have high pressure drag which could be altered by changing the face geometry or by the addition of flaps, to be statically stable about a practical center-of-gravity location, and to be capable of being trimmed by the use of flaps to permit limited control over range and reentry deceleration. Author

N63-12554 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

OVEREXPANDED PERFORMANCE OF CONICAL NOZZLES WITH AREA RATIOS OF 6 AND 9 WITH AND WITHOUT SUPERSONIC EXTERNAL FLOW

Norman T. Musial and James J. Ward Washington, NASA, Sept. 1959 26 p 5 refs

(NASA TM X-83) OTS: $2.60 ph, $0.98 mf (Declassified)

Thrust characteristics and internal pressure distribution of two convergent-divergent nozzles at free-stream Mach numbers of 0 and 2.0 to 3.5 were investigated in the 10- by 10-foot supersonic tunnel. Nozzle flow expansion under all free-stream conditions followed one-dimensional theory until separation from the nozzle wall. In quiescent air the nozzle flow expanded to a pressure about half of ambient before separation. At the same effective pressure ratio with Mach 2.0 external flow, the nozzle flow separated at approximately the base pressure. Large quantities of secondary air, injected near the nozzle exit, decreased the primary nozzle overexpanded thrust loss at the low supersonic Mach numbers; however, in most cases there was no net gain in thrust as compared with ideal expansion of both flows. Author

N63-12555 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

THE LOW-SPEED STATIC LONGITUDINAL AND LATERAL CHARACTERISTICS OF A DELTA-WING MODEL WITH FIXED AND FREE-FLOATING CANARD SURFACES

William I. Scallion and Michael D. Cannon Washington, NASA, Oct. 1959 59 p 10 refs

(NASA TM X-120) OTS: $5.60 ph, $1.97 mf (Declassified)

An investigation was conducted in the Langley full-scale tunnel to determine the low-speed characteristics of a delta-wing model with 15- and 20-percent wing-area canard surfaces in two vertical-tail configurations. Longitudinal and lateral data are presented for an angle-of-attack range of –1.8° to 34.8° with two body nose shapes, with and without strakes, and with the canard surfaces fixed and free floating. Author

N63-12556 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

INVESTIGATION OF THE STATIC LONGITUDINAL STABILITY AND ROLL CHARACTERISTICS OF A THREE-STAGE MISSILE CONFIGURATION AT MACH NUMBERS FROM 1.77 TO 2.87

Donald T. Gregory and Ausley B. Carraway Washington, NASA, Oct. 1959 30 p
(NASA-TM-X-124) OTS: $2.60 ph, $1.10 mf (Declassified)

An investigation has been conducted in the Langley Unitary Plan wind tunnel to determine the effect of body deflection between missile stages and the effectiveness of fin cant angle in producing roll. This paper contains axial-force and static longitudinal stability characteristics obtained at Mach numbers of 1.77, 2.16, 2.54, and 2.87. The corresponding Reynolds numbers (based on model length) were 24.9×10^6, 21.9×10^6, 17.7×10^6, and 20.1×10^6. Author

N63-12557 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

STATIC LONGITUDINAL STABILITY CHARACTERISTICS OF A BLUNTED GLIDER REENTRY CONFIGURATION HAVING 79.5° SWEEPBACK AND 45° DIHEDRAL AT A MACH NUMBER OF 6.2 AND ANGLES OF ATTACK UP TO 20°

Edward E. Mayo Washington, NASA, Oct. 1959 17 p 3 refs
(NASA-TM-X-222) OTS: $1.10 ph, $0.80 mf (Declassified)

The free-stream Reynolds number for the investigation was 3.0×10^6 based on the model length of 7.5 inches. The investigation showed that incorporating 10° nose incidence resulted in a lower lift-curve slope, lower lift-drag ratio, higher value of trim lift coefficient, and a decrease in longitudinal static stability. The aerodynamic effect of changing boattail angle was less than those from the 10° nose inclination. Author

N63-12559 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

WIND-TUNNEL INVESTIGATION AT MACH NUMBERS FROM 0.40 TO 1.20 OF THE STATIC AERODYNAMIC AND CONTROL CHARACTERISTICS OF A MODEL OF A NONLIFTING REENTRY CAPSULE IN COMBINATION WITH A ROCKET BOOSTER

Albin O. Pearson Washington, NASA, Sept. 1960 69 p 2 refs
(NASA TM X-317) OTS: $6.60 ph, $2.27 mf (Declassified)

The investigation was conducted in the Langley 8-foot transonic pressure tunnel over an angle-of-attack range which at its maximum extended from -9° to 9°. The Reynolds number varied from 0.86×10^6 to 1.56×10^6. The all-movable control surfaces were mounted on the tips of the horizontal stabilizing fins. Author

N63-12561 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HEAT TRANSFER TO BLUNT AXIALLY SYMMETRIC BODIES

John O. Reller, Jr. Washington, NASA, Sept. 1960 40 p 14 refs
(NASA TM X-391) OTS: $3.60 ph, $1.40 mf (Declassified)

A large number of bodies of revolution were tested to determine the effects on heat-transfer rates of variations of body shape. Included in the investigation were the effects on heat-transfer rates of changes in body fineness ratio, ratio of nose to base diameters, and nose profile—including the addition of spikes. Comparisons of some of the test results were made with available analytical methods for estimating heating characteristics. The test ranges of nose to base diameter ratios and body fineness ratios were, respectively, 0 to 1 and 0.3 to 2.0. Test Mach numbers were from 3.0 to 6.3. Author

N63-12607 Weapons Research Establishment (Australia)

THE FLIGHT DYNAMICS OF A BOMB WITH CRUCIFORM TAIL: NOTE ON THE EFFECT OF NON-LINEAR YAW-INDUCED ROLLING MOMENTS AND SIDE MOMENTS

W. R. Chadwick Sept. 1962 34 p 11 refs
(Tech. Note SAD-102)

A mathematical model has been designed to describe the free-flight performance of a rigid ballistic missile. In conjunction with the W.R.E. IBM 7090 digital computer the model has been used to determine the influence of nonlinear, yaw-induced rolling moments and side moments on the dynamic stability and performance of a typical bomb with cruciform tail. Specifically, two problem areas relating to roll lock-in and catastrophic-yaw have been studied—the first associated with roll-yaw resonance and the second embracing flight instabilities which have been observed to follow from large amplitude launching disturbances. As a result of these studies, it has been possible to establish design criteria which should assist in improving bomb ballistic performance. Author

N63-12647 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

HEAT TRANSFER IN REGIONS OF SEPARATED AND REATTACHED FLOWS

Davis H. Crawford and Charles B. Rumsey Washington, NACA, June 10, 1957 14 p 10 refs
(NACA RM L57D25b) OTS: $1.60 ph, $0.80 mf (Declassified)

This paper considers the effects of separation on heat transfer and has indicated a method for reducing separation. The heat transfer in regions of separation and reattachment for a few specific shapes are given. These results show that the heat transfer in a separated region is strongly affected by the extent of separation, the location of the reattachment point, and the location of transition along the separated boundary. Author

N63-12648 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

LOCAL HEAT TRANSFER TO BLUNT NOSES AT HIGH SUPERSONIC SPEEDS

William E. Stoney, Jr. Washington, NACA, July 12, 1957 12 p 15 refs
(NACA RM L57D25C) OTS: $1.60 ph, $0.80 mf (Declassified)

A brief summary is presented of the recent theoretical and experimental work on local heat-transfer rates on blunt-nose bodies. Comparisons of theoretical and measured heating rates indicate the following conclusions: The calculation of local conditions over noses of high radius of curvature needs more study and testing at the present time. If local flow conditions are known, the laminar heating rates over the whole nose shape can be calculated within most engineering accuracy requirements for the whole range of Mach numbers up to 13.8. For the case of turbulent flow, turbulent flat-plate theory based on local flow properties can provide good estimates of the heating rates possible. The prediction of transition remains at present the biggest unknown. Author

N63-12701 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STATIC AERODYNAMIC CHARACTERISTICS OF A SHORT BLUNT 10° SEMIVERTEX ANGLE CONE AT A MACH NUMBER OF 15 IN HELIUM

Melvin J. Fohrman Washington, NASA, Feb. 1963 37 p 12 refs
(NASA TN D-1648) OTS: $1.00

Force, moment, and shock-wave data were obtained on two blunt bodies, one having a flat base and the other a conical afterbody with a semivertex angle of 50°. The Reynolds number for the tests was 2.25×10^6 based on maximum body diameter, and the angle-of-attack range extended from 0° to 180°. The data were compared to modified Newtonian theory, theoretical values for a cone, a numerical flow-field analysis, and an approximate method for predicting the forebody shock wave. Author

N63-12750 Aro, Inc., Arnold Air Force Station, Tenn.

BIBLIOGRAPHY: THE MAGNETIC SUSPENSION OF WIND TUNNEL MODELS

P. L. Clemens and A. H. Cortner Arnold Engineering Development Center, Feb. 1963 32 p 70 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-63-20)

This is a selective bibliography of the literature on the magnetic suspension of wind-tunnel models, including a chronological arrangement of titles and abstracts under four main headings: Magnetic Suspension for Aerodynamic Testing, Non-Aerodynamic Applications of Magnetic Suspension, Magnetic Circuits and Their Electronic Controls, and Telemetry from Magnetically Supported Aerodynamic Models. An introduction presents a résumé of the state-of-the-art of magnetic model-suspension technology. Author

N63-12775 Martin Co., Denver, Colo.

APPLICATION OF LIGHTHILL'S GAS MODEL TO A DISSOCIATING ISOENERGETIC INVISCID SHEAR LAYER ABOUT BLUNTED BODIES IN HYPERSONIC FLOW

Murray Dryer Dec. 1962 35 p 13 refs
(R-62-22)

An approximate analytical technique is given for calculating an ideal, dissociating gas flowing over a blunted body in hypersonic flow. This technique, an extension of an earlier analysis, may be used at any body station without examining the flow ahead of the station of interest. The method can be used for plasma sheath and inviscid wake diagnostics to complement exact solutions that use the method of characteristics. Therefore, insight is gained to essential features of the flow without considering the detailed composition of real air. To assess the validity and degree of accuracy of these results, numerical solutions obtained by the method of characteristics for real air in equilibrium will be used as a standard of merit. Experimental results, when available, will also be included. Author

N63-12805 AeroChem Research Labs., Inc., Princeton, N.J.

RADIATION COOLING OF AERODYNAMICALLY HEATED SURFACES AT HIGH MACH NUMBERS

Daniel E. Rosner [1962] 77 p 69 refs For presentation at the AGARD 21st Meeting of the Combustion and Propulsion Panel: Supersonic Flow, Chemical Processes and Radiative Transfer, London, Apr. 1-5, 1963
(Contract AF 49(638)-1138)
(TP-60)

Several novel aspects of radiation cooling are discussed, particularly those associated with the occurrence of surface-catalyzed atom recombination at high Mach numbers. An analogy between radiation cooling and chemical surface catalysis is explored, and the dominant effects resulting from interactions between these two processes are illustrated using simple mathematical models which serve to single out the important nondimensional parameters. In connection with flight applications, altitude-velocity maps are presented which provide an overall picture of the regimes in which chemical nonequilibrium effects should be noticeable. Several unexplored areas of potential interest in the design of hypersonic lifting vehicles are outlined and related to the available literature. Interestingly enough, not all of these areas deal with thermochemical effects. Many "classical" problems remain unsolved, as illustrated by a brief discussion of the radiation-cooled flat plate. Author

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes: ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N63-12480 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SOME EFFECTS OF SWEEP AND ASPECT RATIO ON THE TRANSONIC FLUTTER CHARACTERISTICS OF A SERIES OF THIN CANTILEVER WINGS HAVING A TAPER RATIO OF 0.6

John R. Unangst and George W. Jones, Jr. Washington, NASA, Feb. 1963 58 p 3 refs
(NASA TN D-1594; supersedes NACA RM-L55I13a and NACA-RM-L53G10a) OTS: $1.50 (Declassified)

An investigation has been conducted in the Langley transonic blowdown tunnel of the effects of wing planform on the flutter speed at zero angle of attack and Mach numbers from 0.76 to 1.42. Wing planforms having taper ratios of 0.6, aspect ratios of 4, and sweep angles of 0°, 30°, 45°, 52.5°, and 60° were investigated, as were wings having taper ratios of 0.6, sweep angles of 45°, and aspect ratios of 2.4, 4, and 6.4. Experimental and analytical results are presented. Author

N63-12720 David Taylor Model Basin. Aerodynamics Lab., Washington, D.C.

WING-TUNNEL INVESTIGATION OF THE USE OF WING-TIP BLOWING TO REDUCE DRAG FOR TAKE-OFF AND LANDING

Herbert E. White Jan. 1963 36 p 1 ref
(DTMB-AERO-1043)

Tests were conducted on a half-span model of a low-aspect-ratio wing. Both spanwise and chordwise blowing, parallel to, and inclined to the chordal plane were investigated. Lift, drag, and pitching-moment variation with angle of attack were measured for various combinations of jet distribution, jet direction, momentum coefficient, and flap deflection. Tuft-mattress studies show a change in circulation. Author

N63-12762 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

EFFECT OF SEVERAL JET-ENGINE AIR-INLET CONFIGURATIONS ON THE LOW-SPEED STATIC LONGITUDINAL STABILITY CHARACTERISTICS AND QUANTITY FLOW OF A 1/6-SCALE MODEL OF THE MX-1764 AIRPLANE

Delwin R. Croom Washington, NACA, Jan. 12, 1954 21 p 1 ref
(NACA RM SL54A06) OTS: $2.60 ph, $0.83 mf (Declassified)

An investigation was made in the Langley 300 MPH 7- by 10-foot tunnel to determine the effect of wing-root leading-edge and scoop-type jet-engine air-inlet configurations on the static longitudinal stability characteristics and the duct-flow characteristics of a 1/6-scale model of the MX-1764 airplane. The addition of the inlet configurations to the model generally resulted in slight reductions in longitudinal stability and increases of maximum lift coefficient. Pressure data at a survey station located near the duct exit for the model with all intake configurations are presented without analysis. Author

N63-12763 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

THE EFFECT OF SEVERAL JET-ENGINE AIR-INLET CONFIGURATIONS ON THE LOW-SPEED STATIC LATERAL STABILITY CHARACTERISTICS OF A 1/6-SCALE OF THE MX-1764 AIRPLANE

Delwin R. Croom Washington, NACA, Mar. 4, 1954 24 p 2 refs
(NACA RM SL54C12) OTS: $2.60 ph, $0.92 mf (Declassified)

An investigation was made in the Langley 300 MPH 7- by 10-foot tunnel to determine the effect of wing-root leading-edge and scoop-type jet engine air-inlet configurations on the static lateral stability characteristics of a 1/6-scale model of the MX-1764 airplane. Pressure data at a survey station located near the duct exit are presented without analysis for the model with one of the intake configurations at several angles of sideslip and at 0° angle of attack. The addition of the inlet configurations to the model generally had only small effects on the lateral stability. A previous investigation had

shown that the addition of the inlet configurations to the model generally resulted in slight reductions in longitudinal stability and a slight increase in maximum lift coefficient. Author

04 AIRCRAFT

Includes: specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; stability and control.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N63-12471 David Taylor Model Basin. Aerodynamics Lab., Washington, D.C.

PHASE II TETHERED TESTS AND LOW-SPEED FREE FLIGHT TESTS OF GEM III

Arthur E. Johnson Dec. 1962 19 p 3 refs
(DTMB-R-1700; DTMB-AERO-1049)

Following completion of modifications to Phase 1, a configuration involving variable-camber vanes, spoiler flaps, cockpit armor, and bulkhead, control effectiveness was tested in a static test rig. After installation of fins and engine fairings, untethered tests were made at low speeds to determine maximum speed and lateral acceleration. Then, a reversible-pitch shrouded propeller-engine unit was installed between existing nacelles for added propulsion before shipment to Langley Research Center for further testing to establish criteria for GEM flying qualities. Author

N63-12502 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

AERODYNAMIC CHARACTERISTICS OF THE X-15/B-52 COMBINATION

William J. Alford, Jr., and Robert T. Taylor Washington, NASA, June 1959 29 p 5 refs
(NASA MEMO 6-8-59L) OTS: $2.60 ph, $1.07 mf (Declassified)

High-speed wind-tunnel tests, low-speed dynamic model drop tests, and six-degree-of-freedom calculations were made to determine the carry loads, mutual aerodynamic interference effects, and drop characteristics of the X-15 through the B-52 flow field. The results indicated that safe drops should be expected. Author

N63-12503 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.

TRACKING PERFORMANCE OF A SWEPT-WING FIGHTER WITH A DIRECTOR-TYPE RADAR FIRE-CONTROL SYSTEM AND SCOPE PRESENTATION

Howard L. Turner, George A. Rathert, Jr., and Donovan R. Heinle Washington, NACA, Jan. 20, 1958 24 p 8 refs
(NACA RM A57J01) OTS: $2.60 ph, $0.92 mf (Declassified)

Flight tests were conducted in an F-86D airplane in the manual attack mode to determine the effects of two attack-computer parameters, range and projectile time, and one attack-display parameter, steering-dot scale factor, on the tracking performance with a director-type fire-control system. Author

N63-12558 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

ANALYTICAL INVESTIGATION AND PREDICTION OF SPIN AND RECOVERY CHARACTERISTICS OF THE NORTH AMERICAN X-15 AIRPLANE

William D. Grantham and Stanley H. Scher Washington, NASA, Oct. 1960 48 p 7 refs
(NASA TM X-294) OTS: $4.60 ph, $1.64 mf (Declassified)

The results indicated that the airplane, lower rudder on or off, is not likely to enter a spin from trimmed gliding or level flight. A developed spin might be obtained if the airplane receives some violent disturbance, approximating the attitude and motion of a model when launched into a spin tunnel. Such a spin would probably be more readily obtainable when the lower rudder is off than when it is on, and the ensuing spin would be flatter and faster; recovery from the initial phase of this motion would be satisfactory for either configuration. However, if the spin is allowed to develop fully, difficulty may be experienced in effecting a recovery for the lower-rudder-off configuration, but for the lower-rudder-on configuration satisfactory recovery would be obtainable by optimum control technique. Author

N63-12560 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

BASIC PRESSURE MEASUREMENTS ON A 0.0667-SCALE MODEL OF THE NORTH AMERICAN X-15 RESEARCH AIRPLANE AT TRANSONIC SPEEDS

Robert S. Osborne and Virginia C. Stafford Washington, NASA, Oct. 1960 102 p 6 refs
(NASA TM X-344) OTS: $9.10 ph, $3.26 mf (Declassified)

Basic pressure measurements have been made on a 0.0667-scale model of an interim configuration of the North American X-15 research airplane at Mach numbers from 0.60 to 1.18, angles of attack from –20° to 20°, and angles of sideslip from –5° to 5° in the Langley 8-foot transonic pressure tunnel. The results are presented in tabular form without analysis. Author

N63-12563 National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

LANDING-GEAR BEHAVIOR DURING TOUCHDOWN AND RUNOUT FOR 17 LANDINGS OF THE X-15 RESEARCH AIRPLANE

James M. Mc Kay and Betty J. Scott Washington, NASA, Mar. 1961 54 p 7 refs
(NASA TM X-518) OTS: $5.60 ph, $1.82 mf (Declassified)

Data are presented for the pretouchdown condition, the impact period, and the runout phase of the landing for vertical velocities up to 9.5 feet per second and true ground speeds between 145 knots and 238 knots. The dynamic response of the airplane during the impact period is presented in the form of time histories of shock-strut force and displacement, main-gear and nose-gear drag forces, upper-mass acceleration, horizontal-tail setting, horizontal-tail load, airplane angle of attack, and pitching velocity. Also included is the variation of the coefficient of friction of the main-gear skid with ground speed during the runout of a typical landing. Author

N63-12564 National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

LANDING LOADS AND DYNAMICS OF THE X-15 AIRPLANE

James M. Mc Kay and Eldon E. Kordes Washington, NASA, Mar. 1962 17 p 1 ref
(NASA TM X-639) OTS: $1.60 ph, $0.80 mf (Declassified)

The loads, accelerations, and displacements of the X-15 airplane and landing-gear system measured during landing impact are discussed. The measured quantities are related to the initial touchdown conditions and are compared with data from a theoretical analysis to determine the effects of variations in such parameters as elevator position, skid coefficient of friction, main-gear location, and initial touchdown conditions beyond the range of the experimental data. Author

N63-12598 Naval Air Test Center, Patuxent River, Md.

COMBINED STABILITY AND CONTROL AND AIRCRAFT AND ENGINE PERFORMANCE TRIALS OF THE MODEL AO-1AF AIRPLANE Final Report No. 2

James E. Vose, Jr. Apr. 16, 1962 58 p

The Combined Stability and Control and Aircraft and Engine Performance Trials of the model AO-1AF airplane were conducted to evaluate the suitability of the stability and control characteristics and performance of the model AO-1AF airplane for its intended mission of visual or photographic reconnaissance and to determine conformance with applicable specifications and contract guarantees. Results show that the airplane failed to meet 17 flying-qualities specification requirements and 2 engine-performance specification requirements. Contract guarantees for weight empty, stalling speed, maximum speed, take-off distance, and endurance were not met. Correction of 14 deficiencies and incorporation of 5 "WARNING" items in the Operator's Manual are mandatory for satisfactory service use. Correction of 39 deficiencies is desirable for improved service use. The following additional conclusions are made: The aft safe CG position is 30% MAC; removal of leading edge slats and speed brakes for weight-saving purposes should be considered. Author

N63-12646 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

PRESSURE DISTRIBUTION OF A 0.0667-SCALE MODEL OF THE X-15 AIRPLANE FOR AN ANGLE-OF-ATTACK RANGE OF 0° TO 28° AT MACH NUMBERS OF 2.30, 2.88, AND 4.65

B. Leon Hodge and Paige B. Burbank Washington, NASA, May 1960 161 p 5 refs

(NASA TM X-275) OTS: $12.00 ph, $5.03 mf (Declassified)

The pressure distribution was determined on the complete X-15 (configuration 3) for an angle-of-attack range of 0° to 28° and angles of yaw of 0° to ±10° through a Mach number range of 2.30 to 4.65. Results obtained by theories for calculating pressures on isolated shapes, that is, shock-expansion theory, infinite-swept-cylinder theory, and Tsien's hypersonic similarity law are compared with the experimental pressure distribution on the wing, the cylindrical portion of the fuselage, and the fuselage nose and show a reasonable degree of agreement. Author

N63-12665 Civil Aeronautics Board, Washington, D.C.

HANDBOOK OF AIRLINE STATISTICS; 1962 EDITION. DATA FOR INDIVIDUAL CARRIERS, 1951-1961. DATA FOR CARRIER GROUPS, 1926-1961

Washington, GPO, Oct. 1962 557 p

This edition of *Handbook of Airline Statistics* presents: (1) a statistical description of the U.S. airlines, 1961; (2) historical statistics of U.S. airlines, by carrier group, from the earliest available data through calendar year 1961; (3) traffic statistics of the certificated route air carriers, by individual carrier and carrier group, and through calendar years 1951 to 1961; (4) income statement data of the certificated route air carriers, by individual carrier group and through calendar years 1951 to 1961; (5) balance sheet data of the certificated route air carriers, by individual carrier and carrier group, and through calendar years 1951 to 1961; (6) miscellaneous air-transport data; (7) chronologies of air-transport events; (8) a comparison of air-transport with other modes of transportation; and (9) a glossary of air-transport terms. I.v.L.

05 ASTRONOMY AND ASTROPHYSICS

Includes: celestial mechanics; and radioastronomy.

For related information see: 12 Geophysics; and 29 Space Sciences.

N63-12353 Boston U., Mass.

CATALOG OF LUNAR CRATERS I Research Report No. 4

Gerald S. Hawkins and Peter W. Mitchell Nov. 1962 24 p 3 refs

(NASA Grant NsG-246-62)

(*Its* Astronomical Contributions, Ser. II, No. 22) OTS: $2.60 ph, $0.92 mf

Selenographic coordinates of all craters observable on a selected portion of the moon's surface are given, along with the diameter of the crater and comments on its shape. Plate constants are calculated by the method described by Belsky (1962). A.R.B.

N63-12362 Texas Instruments, Inc., Dallas

RADAR ANALYSIS OF THE MOON. PHASE I: FEASIBILITY OF LABORATORY SIMULATION Final Report

Frank E. Kinsman and Jack R. Van Lopik Nov. 30, 1962 138 p 112 refs

(Contract AF 19(628)-480)

(AFCRL-62-1120)

The future use of radar in making specific-property determinations of the lunar surface is dependent upon knowledge of (a) the effects of lunar atmospheric conditions on radar propagation/operation and (b) radar reradiation signatures of possible lunar surface materials. If assessment of radar potentialities for exploration of the moon is to be made, theoretical analyses must be performed to determine possible effects that might be produced on radar propagation/operation if extreme-value estimates for lunar environmental factors are assumed to be correct. Based on currently available data and methods of analysis, such effects are shown to be relatively minor. In view of this determination and the embryonic status of radar terrain analysis (which does not permit reliable interpretation of detailed measurements), fairly gross radar reradiation measurements of postulated lunar materials can be of great value. Radar frequencies at or near X-band (3 cm) and far-field operation are best suited for obtaining these data. Relatively simple facilities appear adequate, but radar reradiation measurements and theoretical determinations might require verification in a facility capable of simulating selected lunar atmospheric and surface conditions. In either case, it appears desirable and feasible to simulate radar analysis of the moon using state-of-the-art radar facilities and postulated lunar surface materials. Author

N63-12383 Wisconsin U., Madison

THE LEAST DENSITY OF A SPHERICAL SWARM OF PARTICLES, WITH AN APPLICATION TO ASTRONOMICAL OBSERVATIONS OF K. KORDYLEWSKI Technical Summary Report

Frederick V. Pohle Dec. 1962 51 p 18 refs

(Contract DA-11-022-ORD-2059)

(MRC-351)

The least constant density of a spherical swarm of particles is first reviewed for the case of circular motion about a fixed attracting mass. The density ratio is defined as the ratio of the density of the swarm to the attracting mass divided by the volume of a sphere whose radius is the radius of the circular orbit. The classical linearized analysis shows that the density ratio must be at least three. This work is extended to take into account the finite size and the variable density of the swarm; the least density ratio is increased in each case. The problem is then generalized to the case where the swarm is located at either of the stable Lagrangian equilateral triangle points (L_4,L_5) in the restricted problem of three bodies. The least density ratio is now 3 to $(9/4)\mu$ to first order terms in μ, and the mass is that of the combined earth-moon system; since μ is approximately 1/82 in the earth-moon system, the change in density from the classical value is slight. Author

N63-12777 Massachusetts Inst. of Tech. Instrumentation Lab., Cambridge

APOLLO GUIDANCE AND NAVIGATION. THE VISIBILITY OF STARS (CALCULATED FROM THE TIFFANY DATA)

Arthur C. Hardy June 1962 11 p
(NASA Contract NAS9-153)
(E-1172) OTS: $1.60 ph, $0.80 mf

From the data accumulated on the subject of visibility by the National Defense Research Committee during World War II at the Louis Comfort Tiffany Foundation, those aspects of interest in connection with the Apollo project have been selected and presented in this report. The experiments were performed in the laboratory and in actual field tests from a destroyer escort. Author

N63-12813 Tokyo U. Tokyo Astronomical Observatory (Japan)
TOKYO MITAKA CATALOGUE OF EQUATORIAL STARS FOR THE EQUINOX 1950.0 (TME)
Kônosuke Tuzi 1962 184 p
(*Its* Annals, Second Ser., v. 8, no. 1)

This catalog was compiled from observations made with the Repsold transit instrument between 1952 and 1961. The observations of the right ascensions of equatorial stars were carried out referring to the FK3 system, and the positions were reduced to the mean equinox 1950.0 using Newcomb's precession constants. R.C.M.

N63-12816 Northrop Corp. Norair Div., Hawthorne, Calif.
REVISED MARK I STAR MAGNITUDE LIST
D. Egger, Jr., and Frank F. Crandell Sept. 1956 31 p 5 refs
(NAI-56-755)

This report contains the results of an extensive investigation to determine an accurate star list for use with the star tracker of the Mark I Guidance System. This system is used in the SM-62A Snark Intercontinental Pilotless Bomber. Accurate magnitude correction to the Mark I System was determined by utilizing existing photoelectric magnitude scales and by correcting this data to the Mark I Tracking System on the basis of comparison of spectral response of the two measurement systems. Author

06 AUXILIARY SYSTEMS

Includes: fuel cells and solar cells; gas turbines; hydraulic, pneumatic, and electrical control systems and actuators; and inverters.

For primary propulsion systems see: 27 Propulsion

For related information see: 08 Communications; 09 Electronics; 10 Facilities; 15 Instrumentation; and 22 Navigation and Guidance.

N63-12417 Naval Research Lab., Washington, D.C.
PROTON DAMAGE TO SILICON SOLAR CELLS
J. F. Weller *In its* Report of NRL Progress Jan. 1963 p 1-6 7 refs
(See N63-12416 06-01) OTS: $1.25

Several types of silicon solar cells have been irradiated with approximately 4.8-Mev protons. Variations in the cells irradiated in the experiment were bulk material, impurity concentration, and oxygen concentration. Changes in diffusion length, spectral response, and current-voltage characteristics show that the n/p cell is more radiation-resistant than the p/n. No difference in radiation resistance is seen by varying the oxygen concentration, but there is a trend toward increased radiation resistance as the resistivity of the bulk is increased. Author

N63-12532 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio
EXPERIMENTAL INVESTIGATION OF A HIGH SUBSONIC MACH NUMBER TURBINE HAVING HIGH ROTOR BLADE SUCTION-SURFACE DIFFUSION
William J. Nusbaum and Cavour H. Hauser Washington, NACA, Nov. 20, 1956 20 p 4 refs
(NACA RM E56I18) (OTS: $1.60 ph, $0.80 mf (Declassified)

The overall performance of the subject turbine showed that the efficiencies of this turbine and a turbine having the same design characteristics but low rotor blade suction-surface diffusion were nearly the same at equivalent design specific work output and blade speed. The rotor blade momentum loss for the subject turbine was considerably greater than that for transonic turbine rotors having the same average total surface diffusion parameter. This comparison indicated that rotor blade momentum loss depends not only on surface diffusion but also on the effects of variation in the velocity distribution for a given surface diffusion and solidity and on the effects of changes in the losses attributable to secondary flows. Author

N63-12708 Radio Corp. of America. Astro-Electronics Div., Princeton, N.J.
SOLAR CELL ARRAY OPTIMIZATION [Final Report, October 1961 through June 1962]
David Massie Wright-Patterson AFB, Ohio, Flight Accessories Lab., Dec. 1962 103 p 6 refs
(Contract AF 33(616)-7415)
(ASD-TR-61-11, Vol. III)

The overall objective of the work is the achievement of the maximum electrical power conversion, in space, of solar energy per unit of system weight. The objectives of this phase were: (1) to continue research on photovoltaic materials, (2) to develop the crystal-layer conversion to the point of fabricating cells for delivery, and (3) to fabricate for delivery one square foot of large-area, thin-film, CdS photovoltaic cells. Research results are as follows: (1) Research of photovoltaic materials has shown the feasibility of fabricating cells with the p-n junction far removed from the surface by means of heterogeneous cell formation, of fabricating cells by the silkscreen technique of applying the active material, and also has shown that CdS polycrystalline cells are more resistant (by a factor of 104) to 1.6 Mev protons and (by a factor of 10) to 0.8 Mev electrons than are n-on-p silicon cells. (2) The maximum efficiency of converted cells was about 0.7 percent; additional research is needed. (3) Efficiency of the best four-inch-square cell was 1.2 percent. This is to be compared with the maximum efficiency of 5.7 percent obtained for small-area cells of 0.2 cm^2. Author

N63-12709 General Motors Corp. Delco-Remy Div., Anderson, Ind.
DEVELOPMENT OF SEALED SILVER OXIDE-ZINC SECONDARY BATTERIES [Final Report, 30 June 1960-30 June 1962]
J. J. Lander and J. A. Keralla Wright-Patterson AFB, Ohio, Flight Accessories Lab., Oct. 1962 159 p 263 refs
(Contract AF 33(600)-41600)
(ASD-TDR-62-668)

Research and development program was conducted to provide a hermetically sealed silver oxide-zinc battery for use in satellite applications. Problem areas considered were: silver migration in cell, battery voltage regulation, zinc particle size and displacement during cycling, gas evolution, and terminal sealing. Sealed cells were designed, constructed, and tested electrically and environmentally. Eighty-nine cells were cycled to failure. On the basis of cell testing, batteries were designed, constructed, and life-cycle-tested. Twelve batteries were cycled to failure; one additional battery was tested environmentally. Author

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N63-12718 Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.

SURVEY OF COMPONENT REQUIREMENTS AND AVAILABILITY FOR GAS-COOLED NUCLEAR REACTOR POWER PLANTS—COMPRESSORS AND TURBINES

George Novickis Apr. 1962 631 p 155 refs
(Contract AT(30-1)-2512)
(NYO-9792; I-A2392-6) OTS: $3.00

Closed-cycle gas turbines have a great potential for producing a highly efficient nuclear powerplant. Such turbines are now being developed for three applications: the HTRE program (Heat Transfer Reactor Experiment) for nuclear aircraft propulsion, the MGCR program (Marine Gas Cooled Reactor) for nuclear marine propulsion, and the ML-1 (Mobile Low-Power Gas-cooled Nuclear Power Plant) for nuclear electric power generation in an Army mobile powerplant as part of the Army Gas-Cooled Reactor Systems Program (AGCRSP). Much information can be learned from existing nonnuclear gas turbines. Some characteristics of several nonnuclear gas turbines are examined as well as gas turbine prime movers of 18 notable U.S. gas-cooled nuclear powerplant projects. Turbine and compressor performance, performance improvement, full-load and part-load operation, maintenance, component life, and reliability are discussed. Consideration is given to factors affecting structural integrity of turbomachinery, such as choice of proper materials, vibrations, cooling, and construction features. Author

N63-12742 Atomics International, Canoga Park, Calif.

STATISTICAL ANALYSIS OF SNAP 10A THERMOELECTRIC CONVERTER ELEMENT PROCESS DEVELOPMENT VARIABLES

S. H. Fitch and J. W. Morris Dec. 15, 1962 41 p 8 refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-7288) OTS: $1.00

Statistical analysis, primarily analysis of variance, is applied to evaluate several factors involved in the development of suitable fabrication and processing techniques for the production of lead telluride thermoelectric elements for the SNAP 10A energy-conversion system. The analysis methods are described in some detail as to their application for determining the effects of various processing steps, establishing the value of individual operations, and evaluating the significance of test results. The elimination of unnecessary or detrimental processing steps was accomplished, and the number of required tests was substantially reduced by application of these statistical methods to the SNAP 10A production development effort. Author

N63-12755 Consolidated Vacuum Corp., Rochester, N.Y.

PERFORMANCE OF A DOUBLE-WALLED UHV CHAMBER

R. A. Metcalfe and F. W. Trabert [1961] 21 p 3 refs Presented at the 8th AVS National Vacuum Symposium

An experimental ultra-high-vacuum system employing an inner and outer chamber is described. Its 16-ft.^{3} working volume is somewhat larger than previously reported systems employing this approach. No gaskets are used on flanges on the radiantly heated inner chamber. Pressures of 3×10^{-10} and lower have been observed on both exposed and tubulated B-A type ion gauges. Studies of pressure vs. temperature relationships, outgassing rates, leakage rates, etc., are presented. Measurements made to date indicate the steps required to extend the system's capabilities beyond the 10^{-10} Torr range. Author

N63-12766 Lexington Labs., Inc., Cambridge, Mass.

INVESTIGATION OF HIGH TEMPERATURE THERMAL EXPANSION DEVICES AND DESIGN OF A UNIT FOR USE WITH THERMAL IMAGE HEATING Final Report

Robert C. Folweiler Dec. 15, 1962 28 p 5 refs
(Contract AF 19(628)-1616)
(AFCRL-62-952)

Furnace enclosures have been studied that are to be used with a "double clamshell" arc imager. A design is presented for thermal expansion measurements using optical measuring techniques. The unit is readily adaptable for other measurements, including electrical, kinetic, and mechanical property measurements. A special advantage of the system is lack of added electrical and magnetic fields. A maximum temperature well over 2000° C may be expected using two 5-kw Xenon arc sources. Author

N63-12798 Douglas Aircraft Co., Inc. Aircraft Div., Long Beach, Calif.

CRUISE CONTROL OF TURBOJET AIRCRAFT

C. G. Livingston Jan. 21, 1963 77 p 15 refs
(Contract Nonr-1076(00))
(LB-31183)

A general technique for cruise control of turbojet powered aircraft is developed. Certain limitations on the type of aircraft and powerplant are imposed, but the application of the technique is broad. Beginning with ideal, unconstrained conditions, the technique evolves through the effects of imposed constraints and external forces to an integrated display system that will enable the pilot to optimize cruise management under all realistic conditions. Author

N63-12826 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

A PRELIMINARY REPORT ON TWO BIO-ELECTROGENIC SYSTEMS

L. W. Reynolds and J. J. Konikoff Sept. 1962 26 p 5 refs
(NASA Contract NASw-511)
(R62SD78—Class I) OTS: $2.60 ph, $0.98 mf

The production of electrical energy by biochemical methods was studied. A system consisting of algae and fecal bacteria produced 0.3v at 1.4 to 2.0 ma/ft^2. The biological mechanism was studied by using a simplified system which contained only one organism, Fleischmann's yeast. Electrical properties were evaluated by analyzing polarization curves. These curves show a maximum power output of 0.66 w/ft^2 at 2.2 amps/ ft^2. The catalytic action of the platinum-black was investigated. Author

07 CHEMISTRY

Includes: chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis.

For related information see: 18 Materials, Metallic; 19 Materials, Non-metallic; and 26 Propellants and Combustion.

N63-12372 Aberdeen Proving Ground. Coating and Chemical Lab., Md.

THE DETERMINATION OF CHLORINE ION CONCENTRATION IN INHIBITED ENGINE COOLANTS

Robert Wagner Jan. 9, 1963 9 p 9 refs
(CCL Rept. 135) OTS: $0.50

It is important to determine the concentration of chloride ions in engine coolants, as their presence greatly accelerates corrosion of the system. The presence of mercaptobenzothiazole in inhibited coolants interferes with this determination. A method to determine chlorides in inhibited coolants is described. Author

N63-12373 Aberdeen Proving Ground. Coating and Chemical Lab., Md.

EXPLORATION OF NEW METHODS FOR PREVENTING GALVANIC CORROSION BETWEEN MAGNESIUM AND STEEL

Donald K. Stelling Jan. 8, 1963 13 p 5 refs
(CCL Rept. 136) OTS: $ 0.50

An investigation was conducted to explore new methods of treating magnesium-steel couples after the two metals had been assembled and placed in electrical contact with each other. A phosphate anodizing treatment, prepared with this objective in mind, proved to be ineffective when applied to such couples. The treatment seemed to offer considerable corrosion resistance to magnesium alone when the operating conditions of the treatment were controlled within close limits. Author

N63-12374 Aberdeen Proving Ground. Coating and Chemical Lab., Md.

INFLUENCE OF THE HLB OF A NONIONIC ADDITIVE ON THE DETERGENCY OF ALKALINE CLEANERS CONTAINING AN ANIONIC SURFACTANT

A. Mankowich Jan. 10, 1963 16 p 14 refs
(CCL Rept. 137) OTS: $0.50

The resultant of the combined properties of penetrability, peptization, and wetting, as judged by asphalt detergency, shows synergism on the addition of certain nonionics to medium pH alkaline cleaning solutions containing an anionic surfactant. Nonionic additives with HLB values of 13.2 to 17.1 imparted good to excellent asphalt detergency to solutions containing sodium dodecyl sulphate (SDS) or alkyl (straight chain) aryl sulphonate (SKBS); and nonionics with HLB values of 13.4 to 18.18 gave fair to excellent asphalt removal in cleaners containing sodium oleate. In all three systems, asphalt detergency decreased with further increase in nonionic HLB to 19.05. The anionic with the highest HLB (SDS) formed the most synergistic mixtures in the 13.2 to 17.1 nonionic HLB range. The order of increasing synergism displayed by the anionic surfactants (sodium oleate, SKBS, SDS) with nonionics of 17.1 HLB maximum is that of increasing surface tension of the respective anionics (pure). Increasing HLB of the nonionic additives correlates in general with increasing surface tension of their 0.39% solutions (their concentrations in the cleaning solutions investigated); and the effectiveness of the nonionics in improving asphalt detergency increases with increasing values of nonionic surface tension until a nonionic HLB of 17.1 is reached. The order of increasing synergism in the nonionic HLB range of 13.4 to 17.1 is also that of increasing critical micelle concentration of the pure anionic surfactants. It is indicated that this order is also that of increasing anionic CMC (critical micelle concentration) lowering. A number of synergistic anionic-nonionic surfactant combinations were developed, suitable for use in cleaners of the Federal Specification P-C-436a type. These combinations could meet detergency plus surface tension, or just detergency, requirements of the specification. Author

N63-12400 Washington U., St. Louis, Mo.

EFFECTS OF ION ASSOCIATION ON RATES OF OXIDATION-REDUCTION TRANSFER REACTIONS IN THE NAPHTHALENE-NAPHITHALENIDE SYSTEMS Technical Report No. 3

P. J. Zandstra and S. I. Weissman Jan. 1963 Repr. from J. Am. Chem. Soc., 84, 1962 p 4408-4410 2 refs
(Grant AF-AFOSR-62-365)

The rates of the rapid reactions

$$C_{10}H_8^- + C_{10}H_8 = C_{10}H_8 + C_{10}H_8^- \quad (1)$$

$$C_{10}H_8^-Na^+ + C_{10}H_8 = C_{10}H_8 + Na^+C_{10}H_8^- \quad (2)$$

have been measured in tetrahydrofuran, tetrahydropyran and 2-methyltetrahydrofuran. The processes follow a second order kinetic law. The rates and their variation with temperature depend on solvent: (1) is generally more rapid than (2), but in tetrahydrofuran the rate of (2) increases with decreasing temperature below 300° K and is greater than the rate of (1) below 280° K. Author

N63-12401 Atomic Energy Commission, New Brunswick Lab., N.J.

SEPARATION AND DETERMINATION OF PLUTONIUM IN PLUTONIUM-URANIUM FUEL ELEMENTS

C. E. Pietri Jan. 1963 8 p 6 refs
(NBL-189) OTS: $0.50

Plutonium is separated from uranium in plutonium-uranium oxide and plutonium-uranium carbide reactor fuel element samples by cation exchange. Initially, the refractory oxides or carbides are dissolved by refluxing in concentrated nitric acid-6N hydrofluoric acid solution. After separation, plutonium is determined by potentiometric titration at constant current with potassium dichromate; uranium may be determined similarly. At least 99.9% recovery of both plutonium and uranium was obtained on synthetic samples. Author

N63-12407 Bureau of Mines, Boulder City, Nev.

ELECTROLYTIC METHODS OF PREPARING CELL FEED FOR ELECTROREFINING TITANIUM

Morton Min Wong, R. E. Campbell, D. C. Fleck, and D. H. Baker, Jr. 1963 27 p 11 refs
(BM-RI-6161)

Electrolysis of titanium carbide and a material consisting of titanium, carbon, nitrogen, and oxygen as soluble anodes in fused electrolytes was investigated by the Bureau of Mines for the preparation of crude titanium metal. Tests made in all-chloride electrolytes showed only a low recovery of titanium as well as a substantial volatilization of titanium trichloride ($TiCl_3$) when present in the electrolyte. Electrolysis at 750° to 850° C in a mixture containing 85 percent NaCl-15 percent potassium fluotitanate (K_2TiF_6) yielded as high as 91 percent recovery of titanium from titanium carbide and 62 percent recovery of titanium from the titanium-carbon-nitrogen-oxygen material. Problems associated with the preparation of crude metal by fused-salt electrolysis are discussed. The crude metals produced from both anode materials were electrorefined in a sodium chloride-titanium chloride (NaCl-$TiCl_3$) electrolyte, and ductile titanium metal was obtained. Author

N63-12408 Bureau of Mines. Reno Metallurgy Research Center, Nev.

REACTION RATE OF TITANIUM AND TITANIUM SUBCHLORIDES IN MOLTEN SODIUM CHLORIDE

Thomas A. Henrie, E. K. Kleespies, and D. H. Baker, Jr. 1963 24 p 22 refs
(BM-RI-6162)

A technique was devised for measuring the rate of chemical reactions between reactive metals and molten-salt mixtures at high temperatures. The rate of the heterogeneous reaction between high-purity titanium metal and titanium trichloride in molten sodium chloride was determined. The reaction is surface-controlled, and the heat of activation is 8.29 kilocalories per mole $TiCl_3$. An active site or reaction nuclei is created by adsorbing a $TiCl_3$ molecule at the metal surface. Reaction of the second $TiCl_3$ species forms an activated complex that decomposes into three $TiCl_3$ molecules. Author

N63-12421 California U., Berkeley. Lawrence Radiation Lab.

KINETIC ANALYSIS OF CONSECUTIVE-REACTION MODEL SYSTEMS

Howard R. Siewert, Peter N. Tenney, and Theodore Vermeulen Nov. 30, 1962 108 p 11 refs
(Contract W-7405-eng-48)
(UCRL-10575) OTS: $2.25

Numerical solutions are needed to carry out kinetic calculations of multiple-reaction systems. Two types of consecutive-reaction models are studied here: consecutive-competitive, and consecutive-reversible (with one reversible step). For the consecutive-competitive reaction model, the effect was determined of an excess of either of two reactants on (a) the time for the system to react to a given conversion and

on (b) the relative yields of intermediate and final products. An excess of either reactant is an important design factor, because it may minimize the required reactor volume and maximize the production rate of the desired product. Several different kinds of consecutive-reversible cases are studied. These include cases where all the reaction steps are first-order and cases in which there is at least one second-order step. Except for isolated second-order cases, only the all-first-order cases can be solved analytically. The second-order cases are solved numerically using a fourth-order Runge-Kutta method. In cases which contain a second-order step, the proportions of intermediate and final products are dependent upon the initial reactant concentration regardless of which reaction step is second-order. Author

N63-12424 California U., Livermore. Lawrence Radiation Lab.
HIGH-PRESSURE INVESTIGATIONS OF GROUP III ELEMENTS. PART I: FUSION CURVES AND POLYMORPHIC TRANSITIONS OF ALUMINUM, GALLIUM, INDIUM, AND THALLIUM AT HIGH PRESSURES. PART II: PHASE TRANSFORMATIONS IN URANIUM AT HIGH PRESSURES
A. Jayaraman, W. Klement, Jr., R. C. Newton, and G. C. Kennedy
Nov. 1, 1962 41 p 52 refs
(Contract W-7405-eng-48)
(UCRL-7128) OTS: $1.00

The fusion curves of aluminum and thallium to 50 kbar, and of gallium to 70 kbar, were investigated by differential thermal analysis (DTA). A break in slope of the melting curve of gallium near 45° C and 30 kbar led to the discovery of a new polymorph. This phase, Ga III, is slightly less dense than Ga II, both persisting to 75 kbar. The Ga II to Ga III transition is rapid and characterized by a substantial heat as well as a drop in resistance. From the investigation of the metastability phenomena, it is tentatively concluded that Ga III is identical with Bridgman's Ga II' and that the metastable phase studied by Defrain at one atmosphere is closely related to Ga II. The existence of three polymorphs of thallium is definitely established, although the undercooling noted by Ponyatovskii for the bcc-hcp transition was verified. The triple point for the solid thallium phases is near 115° C and 39 kbar, with melting of the high-pressure polymorph expected above 650° C and 90 kbar. The α-β, β-γ, and the direct α-γ phase transformations in uranium have been studied up to 45 kbar at cooling and heating rates of 3° to 5° C/sec. The overheating and undercooling intervals for the α-β and β-γ transformations at high pressures are about the same as the hystereses expected at zero pressure and do not vary appreciably with increasing contamination. Progressive contamination and resultant lowering of the transformation temperatures of the uranium samples was evident for all containers used, but was least for tantalum containers. The equilibrium α-β-γ triple point occurs at less than 31.5 kbar and greater than 803° C. The γ phase is definitely more compressible than the β phase, and the β phase is probably more compressible than α. There is only a small hysteresis in the α-γ transformation. Author

N63-12426 Feltman Research Labs., Picatinny Arsenal, Dover, N.J.
THE SURFACE CHEMISTRY OF EXPLOSIVES
Cecil G. White, Thomas C. Castorina, J. V. Richard Kaufman, and Samuel Helf Nov. 1962 21 p 6 refs
(Picatinny Arsenal Technical Rept. 3008)

The exploitation of a technique employing the liquid scintillation counting of C-14 labeled adsorbates demonstrates that adsorption onto explosive surfaces can be measured quantitatively. Through the use of this technique, a sensitivity is provided sufficient for detecting quantities of adsorbed material which would not be measurable by ordinary analytical means and makes possible the construction of isotherms on surfaces which might be classified as weakly adsorbing or nonadsorbing. A preliminary experiment using C-14 labeled polymethyl methacrylate of undetermined high molecular weight in toluene has yielded isotherms using HMX and RDX surfaces. An interpretation of these results as a function of molecular weight has led to the selection of various long chain compounds, of varying complexity, as agents to be studied for their ability to adhere to explosive surfaces. An isotherm has been constructed using HMX surface and trimethyl stearylammonium bromide in aqueous concentrations in the order of 10^{-4} molar. The extent of the isotherm is limited only by the solubility of the ammonium salt in H_2O. Other isotherms have been constructed using the ammonium salt, stearyl alcohol, and stearic acid. The latter two compounds exhibited no affinity for organic surfaces when dissolved in benzene and toluene, but did show affinities for PbN_6 surfaces. Author

N63-12431 Bureau of Mines. Salt Lake City Metallurgy Research Center, Utah
TREATING BERYL-SPODUMENE CONCENTRATES CONTAINING 10 TO 30 PERCENT BERYL BY THE FLUOSILICATE PROCESS
Raymond O. Dannenberg, D. W. Bridges, and J. B. Rosenbaum
1963 22 p 42 refs
(BM-RI-6153)

Applicability of the fluosilicate sintering process to recovering beryllium from beryl-spodumene concentrate analyzing 1.4 to 3.7 percent BeO (10- to 30-percent beryl) was investigated. The work was one phase of a Bureau of Mines research program undertaken to assess applicability of conventional processes and to devise new procedures for treating various potential beryllium feed materials. Beryllium recovery of about 70 percent in a product of 99-percent BeO grade was achieved in treating 30-percent beryl concentrate. The process consisted of (1) sintering a briquetted charge of concentrate, soda ash, and sodium fluosilicate for 3 hours at 750° C; (2) extracting the soluble beryllium by multiple stages of water leaching; (3) adding caustic to the leach solution and boiling to hydrolyze and precipitate crude beryllium hydroxide; (4) dissolving the crude beryllium hydroxide in sulfuric acid and separating the solution from undissolved silica; (5) sulfidizing the acid beryllium solution to precipitate heavy metal impurities; (6) adding ammonia to the clarified sulfate solution to precipitate beryllium hydroxide; and (7) converting the hydroxide to beryllium oxide (beryllia) by calcining at 900° C. About 60 percent more sodium fluosilicate was required per unit of beryl than is used industrially in treating 10- to 12-percent BeO concentrate (80- to 90-percent beryl). Recovery decreased, and flux requirements increased, when treating concentrates containing less beryl. Author

N63-12435 Atomic Energy Commission. New Brunswick Lab., N.J.
Annual Progress Report for the Period July 1961 through June 1962 [CHEMICAL ANALYSES]
C. J. Rodden Dec. 1962 92 p 46 refs
(NBL-188) OTS: $2.25

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7. A CHEMICAL URANIUM BIAS CHECK PROGRAM J. Paul Highfill p 61-67 (See N63-12442 06-07)
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9. THE DETERMINATION OF IMPURITIES IN BERYLLIUM METAL BY X-RAY FLUORESCENCE A. J. Busch and C. G. Goldbeck p 87-95 (See N63-12444 06-07)
10. THE DETERMINATION OF ENRICHED URANIUM IN UO_2-STAINLESS STEEL SOLUTIONS BY X-RAY FLUORESCENCE A. J. Busch p 97-98 1 ref (See N63-12445 06-07)

N63-12436 Atomic Energy Commission. New Brunswick Lab., N.J.
SPECTROPHOTOMETRIC DETERMINATION OF SILICON IN THORIUM DIOXIDE
A. R. Eberle and L. J. Pinto *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 7 1 ref (See N63-12435 06-07) OTS: $2.25

The procedure of Menis and Manning for the determination of silica in thorium oxide was found to be unsatisfactory for the analysis of very refractory oxide samples. The procedure was, therefore, modified so that this type of sample could be analyzed. Author

N63-12437 Atomic Energy Commission. New Brunswick Lab., N.J.
SPECTROPHOTOMETRIC DETERMINATION OF ZIRCONIUM IN THORIUM-ZIRCONIUM ALLOYS
A. R. Eberle, L. J. Pinto, and M. W. Lerner *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 8 (See N63-12435 06-07) OTS: $2.25

Zirconium is precipitated by p(p-dimethylaminophenylazo)-benzenearsonic acid (DPB) in hydrochloric acid solution. The precipitate can be dissolved in either a basic or acid fluoride solution to release the free DPB which is yellow in basic solution and red in acidic solution. Although thorium is also precipitated to some extent by DPB, it has been found that under specific precipitation conditions the coprecipitation of thorium is constant and reproducible. Thus, low thorium-zirconium alloys can be analyzed simply and accurately. The details of the procedure have been published in "Analytical Chemistry". Author

N63-12438 Atomic Energy Commission. New Brunswick Lab., N.J.
DETERMINATION OF TUNGSTEN IN REACTOR MATERIALS—EXTRACTION AND SPECTROPHOTOMETRIC DETERMINATION WITH 8-QUINOLINOL
A. R. Eberle *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 9 (See N63-12435 06-07) OTS: $2.25

In the analysis of zirconium metal and Zircaloy samples, inconsistent tungsten values were obtained with the conventional thiocyanate, dithiol, and hydroquinone methods. Continuing the studies of the extraction and spectrophotometric determination of various metals with 8-quinolinol (oxine), a procedure for the determination of tungsten was developed that is also applicable to the analysis of uranium, beryllium, and stainless steel. The procedure, involving the preliminary extraction of interfering molybdenum from 0.15% hydrofluoric acid solution followed by addition of boric acid and extraction of the tungsten from the solution adjusted to pH 2.0, was presented at the 1962 Gatlinburg Conference on Analytical Chemistry in Nuclear Reactor Technology. Author

N63-12439 Atomic Energy Commission. New Brunswick Lab., N.J.
NEUTRON ACTIVATION ANALYSIS OF URANIUM-235 WITH IMPROVED PRECISION AND ACCURACY
H. Bussell, C. L. Zyskowski, and L. C. Nelson, Jr. *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 10 (See N63-12435 06-07) OTS: $2.25

A method reported previously for the determination of uranium-235 by neutron activation has been improved by increasing the neutron flux, the scintillation counter sensitivity, and the sample size. Counting rates have resulted which were large enough to give precisions and accuracy relative to synthetic standard of the order of 0.1% uranium-235 in the range of 15% to 93% uranium-235. A 5-g. Ra-Be neutron source is used to activate samples containing 500 mg. of pure U_3O_8 and a 4- × 4-inch, well-type, NaI(Tl) crystal is used in the scintillation detector assembly. Neutron induced fission counting rates of 1 to 2 × 10^6 per minute are faithfully reproduced, by the use of stable, automatic timers and scalers. A detailed report was given at the Sixth Conference on Analytical Chemistry in Nuclear Reactor Technology in October 1962 at Gatlinburg, Tennessee. Author

N63-12440 Atomic Energy Commission. New Brunswick Lab., N.J.
SPECTROCHEMICAL DETERMINATION OF BORON IN 8N NITRIC ACID SOLUTIONS
A. W. Wenzel and C. E. Pietri *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 33-36 4 refs (See N63-12435 06-07) OTS: $2.25

The spectrographic determination of boron in plutonium is based on an anion-exchange separation of plutonium in 8N nitric acid and subsequent concentration of the boron-rich effluent by evaporation. The purpose of this study is to attempt to extend the range in which mannitol is useful in inhibiting boron loss in nitric acid media from 10%/o to 50%/o (8N) nitric acid. If the boron loss in 8N nitric acid could be reduced using mannitol, the limit of detection for boron may be lowered substantially since the amount of the element available for excitation would be increased. Accordingly, several modifications of the mannitol complexing method were made in order to study its effectiveness in preventing loss of boron upon evaporation of 8N nitric acid solution. Author

N63-12441 Atomic Energy Commission. New Brunswick Lab., N.J.
STABILITY OF DICESIUM PLUTONIUM HEXACHLORIDE
C. E. Pietri *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 45-46 2 refs (See N63-12435 06-07) OTS: $2.25

The preparation and stoichiometry of dicesium plutonium hexachloride, Cs_2PuCl_6, has been reported previously, along with initial stability tests to determine its suitability as an analytical plutonium standard. Current investigations disclose continued slight but significant instability. Author

N63-12442 Atomic Energy Commision. New Brunswick Lab., N.J.
A CHEMICAL URANIUM BIAS CHECK PROGRAM
J. Paul Highfill *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 61-67 (See N63-12435 06-07) OTS: $2.25

In the commercial reactor field, a rigid analytical control program was devised and carried out for the Power Reactor Development Company (PRDC), Detroit, Michigan, in the second core loading of the Enrico Fermi reactor. The New Brunswick Laboratory (NBL) was requested to aid in setting up a program, as well as to prepare and verify the uranium content of synthetic known solutions used for control purposes. An analytical control plan was devised and carried out for the second core loading of this reactor. This plan is presented. It illustrates the cooperation existing between commercial reactor owners and Government in dealing with the accountability of SS material. Author

N63-12443 Atomic Energy Commission. New Brunswick Lab., N.J.
DETERMINATION OF BORON IN PLASTIC TAPE IMPREGNATED WITH BORON CARBIDE
H. Zibulsky and J. S. Pailer *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 69-71 6 refs (See N63-12435 06-07) OTS: $2.25

Various methods of analysis were investigated for separating and determining the boron content (0.3 mg. to 0.9 mg. B per square centimeter) of plastic tape impregnated with boron carbide. A survey of boron procedures considered for this study revealed that boron was determined in uranium-Zircaloy fuel alloys, in high-temperature alloys, and in graphite, at concentrations of 0.01 to 0.05 percent, by photometric measurement of the color produced when quinalizarin and boron react in sulfuric acid. Boron was also determined photometrically in waters, soil extracts, plant materials, and aluminum-uranium alloys using carminic acid. The volumetric procedure of Hollander and Rieman, with modifications, was found to be applicable, and was preferred for this analysis. Details of the modified version of this procedure follow. Author

N63-12444 Atomic Energy Commission. New Brunswick Lab., N.J.
THE DETERMINATION OF IMPURITIES IN BERYLLIUM METAL BY X-RAY FLUORESCENCE
A. J. Busch and C. G. Goldbeck *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 87-95 (See N63-12435 06-07) OTS: $2.25

Samples of beryllium metal are received at the New Brunswick Laboratory for analysis of various impurities to determine whether they conform to specifications. These samples are now analyzed chemically and spectrographically; however, a more rapid method is always desirable. The advantages of X-ray fluorescence analysis are well known, such as speed, nondestruction of sample, and a simple spectra compared with optical spectrography. For these reasons an X-ray assay procedure was developed which is rapid, requires little sample preparation, and still achieves reasonable accuracy and precision. No fluorescent spectra is produced by beryllium detectable under the conditions of this work, and since the mass absorption coefficient of beryllium is extremely small, the limit of detection of the elements in the beryllium matrix will be one of the lowest that can be achieved by X-ray fluorescence. This method works well if the concentration of the total impurities is not too high, so as not to cause absorption effects. Author

N63-12445 Atomic Energy Commission. New Brunswick Lab., N.J.
THE DETERMINATION OF ENRICHED URANIUM IN UO_2-STAINLESS STEEL SOLUTIONS BY X-RAY FLUORESCENCE
A. J. Busch *In its* Annual Progress Report [Chemical Analyses] Dec. 1962 p 97-98 1 ref (See N63-12435 06-07) OTS: $2.25

The concentration of enriched uranium in seventeen unknown UO_2-stainless steel solutions was determined by X-ray fluorescence using strontium as an internal standard. A uranium calibration curve was plotted, using uranium-stainless steel solutions in 5N HNO_3 (with a concentration range from 0.6189 mg. U/ml. to 5.4463 mg. U/ml.), which shows the intensity ratio of U/Sr in counts per second versus the concentration of uranium in stainless steel solutions in mg./ml. Weighed aliquots (10-ml.) of each of the unknown solutions were taken (Sr Internal Standard solution was added) and diluted to 25 ml. with 5N HNO_3. Each ratio of U/Sr was plotted on the calibration curve, then multiplied by the dilution and 93% enrichment factors. The resultant concentrations were calculated to a weight basis (g./g.) to conform to analytical chemical basis of reporting results. Samples were first assayed by the X-ray procedure and the results of the X-ray analyses were given to the Analytical Chemical Section as a guide to the enriched uranium concentrations of the samples. The total time for pouring solutions into the X-ray sample cells and counting the uranium peaks (including internal standard peaks and backgrounds) was 15 minutes for each sample. The results of the X-ray and chemical analyses are shown. X-ray analysis has been applied to the analysis of uranium in UO_2-stainless steel materials and has been shown to be a procedure satisfactory for determining the uranium within approximately 5 percent of the uranium content. Author

N63-12447 Comitato Nazionale per l'Energia Nucleare. Lab. Chimica Industriale, Rome (Italy)
ANALISI SPETTROGRAFICA DI IMPUREZZE METALLICHE NEL SANTOWAX [SPECTROGRAPHIC ANALYSIS OF METALLIC IMPURITIES IN SANTOWAX]
L. Lorenzini and G. Bracciocurti CNEN Div. Affari Intern. e Studi Econ., Uffic. Pubbl., Oct. 1962 31 p 2 refs In Italian; English summary
(RT/CHI(62)13)

In this paper a spectrographic procedure for the determination of B, Cd, Fe, Ni, Cr, Mn and Mo in Santowax OMP is described. The detection sensitivity is 0.05 ppm; the quantitative determination can be carried out to concentrations of 0.25 ppm with a mean standard deviation between 1.7 and 4%. Author

N63-12458 Massachusetts Inst. of Tech., Cambridge
THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS A. Semi-annual Progress Report for the Six-Month Period Ending October 31, 1962
W. Nummela et al AEC Div. Tech. Information, Oct. 31, 1962 47 p 3 refs
(Contract AT(30-1)-956) OTS: $1.00
(MITS-49)

New research techniques adapted to mineral engineering include: (1) mixed adsorption of water vapor and vaprized n-butyl amine on ferric oxide; (2) adsorption in the hematite-water-diisobutyl ketone system; (3) adsorption of inorganic ions, such as hydrogen, on ferric oxide; (4) hysteresis of contact angles in the following two liquid-liquid-solid systems—benzene-water-quartz in the presence of the surfactant, dodecyl ammonium chloride, and water-diisobutyl ketone-hematite; and (5) the mechanism of polyacrylamide adsorption by kaolinite. I.v.L.

N63-12473 Naval Radiological Defense Lab., San Francisco, Calif.
A SYSTEM FOR RAPID HANDLING OF AN IRRADIATED SOLUTION
A. E. Greendale and D. L. Love Nov. 13, 1962 12 p
(USNRDL-TR-601)

An apparatus has been constructed for rapidly transferring irradiated solutions to a container for fast radiochemical separations. A "rabbit" containing a solution is irradiated; within 1 second after irradiation it is transported through a pneumatic system to a receiver; there it impales itself onto two hypodermic needles connected to a container under vacuum. The irradiated solution and one acid wash of the rabbit are quantitatively transferred to the container within 2 seconds. Since the system is completely contained, there is no contamination of the laboratory area nor danger to personnel. Author

N63-12487 Rocket Power, Inc., Pasadena, Calif.
STUDY OF ROCKET ENGINE EXHAUST PRODUCTS Sixth Quarterly Report, 1 Sept. 1962 through 30 Nov. 1962
M. A. Greenbaum et al [1962] 25 p 31 refs
(Contract AF 04(611)-7414)
(QR-7414-6)

Specially designed apparatus for use in the studies of the thermodynamic properties of BeCl, $BeCl_2$, BeO, and Be_3N_2 has been constructed. These items include an electron bombardment furnace—Southard drop calorimeter combination for the study of the heat capacity and heat of fusion of BeO; an ultrahigh vacuum system (10^{-10}mm of Hg) for the study of the vapor pressures of $BeCl_2$ and Be_3N_2; and a vacuum apparatus for the molecular flow effusion study of the thermodynamics of BeCl(g). Preliminary values for the heat of formation of BeCl(g) and the heat of sublimation of $BeCl_2$ have been obtained. Author

N63-12548 International Union of Pure and Applied Chemistry
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF GASES AND GAS-CONDENSED PHASE REACTIONS, NO. 6
L. Brewer, comp. (U. of Calif.) Dec. 31, 1962 14 p 115 refs

N63-12585 International Union of Pure and Applied Chemistry
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS IN THE CONDENSED STATE, NUMBER 4, OCTOBER, NOVEMBER, DECEMBER 1962
J. J. Diamond, ed. [1961] 58 p 586 refs

N63-12599 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham
THE KINETICS OF THE THERMAL DECOMPOSITION OF CHLORINE-HEPTOXIDE IN THE GASEOUS PHASE (DIE KINETIK DES THERMISCHEN ZERFALLS VON GASFORMIGEN CHLOR-HEPTOXYD)
R. V. Figini, E. Coloccis, and H. J. Schumacher Nov. 1962 18 p 7 refs Transl. from Z. Physik, Chem. (Frankfurt), v. 14, 1958 p 34-48
(TIL/T-5314)

The kinetics of the decomposition are investigated at pressures between 1.5 and 80 mm Hg and temperatures between 100° and 120° C, in pyrex and quartz reaction vessels. The reaction is monomolecular homogeneous and pressure-dependent in a given range. The energy of activation is 32.9 ± 1.5 Kcal. The half-value pressure at 1 mm Hg is determined. All degrees of freedom of the Cl_2O_7 contribute to the activation. The critical decomposition energy has a value of 48.2 Kcal. Author

N63-12600 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham
THE KINETICS OF THE REACTION OF ClO_2 WITH NO_2 IN THE SOLUTION PHASE (DIE KINETIK DER REAKTION VON ClO_2 MIT NO_2 IN DER LÖSUNGSPHASE)
H. Martin and R. Gareis Nov. 1962 10 p 8 refs Transl. from Z. Elektrochem., v. 60, 1956, p 959-964
(TIL/T-5373)

The step $ClO_2 + NO_2 \rightarrow NO_3 + ClO$ which determines the rate of the gas reaction $ClO_2 + 3NO_2 = NO_2Cl + N_2O_5$ requires an activation energy of only 11 kcal, despite the slow reaction progress at room temperature. This is explained on the basis of the absolute reaction rate and is confirmed by an investigation of the reaction in solution phase and comparison with the gas phase reaction. Author

N63-12617 Rice U., Houston, Tex.
A HIGH TEMPERATURE CALORIMETER; THE ENTHALPIES OF α-ALUMINUM OXIDE AND SODIUM CHLORIDE
Rapier Dawson, Elizabeth B. Brackett, and Thomas E. Brackett [1961] 10 p 8 refs Submitted for Publication
(NASA Grant NsG-6-59)
OTS: $1.10 ph, $0.80 mf

The construction and operation of a high-temperature calorimeter is described. The enthalpy of a sample of α-aluminum oxide furnished by the National Bureau of Standards has been measured from 750° K to 1400° K and found to be about 0.3% higher than the enthalpy reported by the N.B.S. in the region in which it can be compared. The enthalpy of sodium chloride has been measured and found to fit the equations $(H_T - H_{298.15}) = 9.89T + 0.00273T^2 - 55{,}380T^{-1} - 3{,}006$ cals./mole [600° K<T≤1073.8° K; ± 0.2%] and $(H_T - H_{298.15}) = 25.24T - 0.00376T^2 - 5{,}307$ cals./mole [1073.8° K≤T<1300° K; ± 0.1%]. Author

N63-12650 Texas A. and M. Research Foundation, College Station
NUCLEAR ACTIVATION ANALYSIS. RECENT DEVELOPMENTS IN THE TECHNIQUE, AND ITS INHERENT ATTRIBUTES GIVE PROMISE OF WIDE APPLICABILITY
Richard E. Wainerdi [1962] 31 p 48 refs Submitted for Publication
(NASA Grant NsG-256-62)
OTS: $3.60 ph, $1.13 mf

Advancements in technique development of nuclear activation analysis, based on nuclear transmutation, are discussed. Results indicate that this method of analysis, whether it uses instrumental (gamma-ray spectrometry) or radiochemical procedures, manual or automatic systems, will offer an increasingly precise and sensitive elemental analysis, and do it rapidly at relatively low cost. I.v.L.

N63-12657 Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION. ANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1962
M. T. Kelley and C. D. Susano Feb. 8, 1963 168 p refs
(Contract W-7405-eng-26)
(ORNL-3397) OTS: $2.75

Analytical research encompassed: analytical instrumentation, chemical analysis of advanced reactor fuels, analysis of molten salt by electrochemical methods, special research problems such as spectrometric studies, gas-cooled reactor project analyses, effects of radiation on analytical methods, X-ray and spectrochemical analyses, mass spectrometry, optical and electron microscopy, nuclear and radiochemical analyses, inorganic and organic preparations. Analytical development encompassed ionic analyses and infrared studies. Service analyses encompassed: quality control, low-level radiochemical laboratory, mass spectrometric analyses, spectrochemical analyses laboratory, process analyses, reactor engineering service laboratory, and gas-cooled reactor project. I.v.L.

N63-12707 National Bureau of Standards, Washington, D.C.
PYROLYSIS OF POLYTRIFLUOROETHYLENE—INFLUENCE OF GAMMA RADIATION AND ALKALI TREATMENT
Sidney Straus and Leo A. Wall [1962] 24 p 11 refs Presented in part before American Chem. Soc., Atlantic City, Sept. 14, 1962 Submitted for publication
(NASA Order R-56)
OTS: $2.60 ph, $0.92 mf

Pyrolysis in vacuum of gamma irradiated polytrifluoroethylene indicates increased rates of volatilization with increased dosage. At the higher radiation doses, the rate curves no longer show a maximum but resemble those previously obtained with branched polyethylenes. Studies of swelling with acetone indicate crosslinking, which increases with radiation dose. It is estimated that for each chain fracture caused by radiation there are approximately seven crosslinks formed. However, in addition to the crosslinks a branched structure is also being produced, as evidenced by the character of the thermal degradation rate curves. Alkali treatment of the polymer sensitizes it towards dehydrofluorination and double bond formation. Subsequent rate and pyrolysis studies showed the formation of very stable residues, indicating a relatively greater thermal stability of the main chain. Author

N63-12711 Cincinnati U., Ohio
BASICITY OF N-NITROSAMINES. II. AQUEOUS SULFURIC ACID SOLUTIONS Technical Report No. 3
Hans Zimmer, Hans H. Jaffe, and William S. Layne Jan. 3, 1963 23 p 8 refs
(Contracts DA-33-008-ORD-1757; DA-33-008-ORD-1971)
(AROD-2276-3)

The ultraviolet spectra of dimethyl-N-nitrosamine and diisopropyl-N-nitrosamine were examined in aqueous sulfuric acid solutions, and

the changes of spectra were observed at a number of acid concentrations. The changes of spectra indicate the N-nitrosamine molecule exists in four spectroscopically distinguishable forms in aqueous acidic solution, with the proportion of each determined by the acid concentration. The first and second equilibrium constants were calculated, and their dependence on acid concentration indicates the reactions producing spectral change are the formation of hydrogen bonds between the N-nitrosamine molecule and sulfuric acid. White, crystalline 1:1 addition compounds of di-n-heptyl-N-nitrosamine, di-n-octyl-N-nitrosamine, and bis-(2-ethylhexyl)-N-nitrosamine with perchloric acid were prepared. Author

N63-12722 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham

THE VISCOMETRIC DETERMINATION OF THE MOLECULAR WEIGHT OF POLYMERS (DIE VISCOSIMETRISCHE MOLEKULARGEWICHTSBESTIMMUNG VON POLYMEREN)

G. Meyerhoff Dec. 1962 47 p 211 refs Transl. from Fortschr. Hochpolymer. Forsch. (Berlin), 3 (1), 1961 p 59-105
(TIL/T-5363)

Effects of inhomogeneity on the viscosity determinations, which assume homogeneous polymers, are considered. The calibration techniques then applied are discussed and examples given. The application of the derived quantities to the calculation of physical dimensions of molecules, such as the Gaussian coil of cellulose nitrate, is demonstrated and the results are compared with those derived from light-scattering measurements. Effects of branching on viscosity are considered. Author

N63-12731 Arizona U., Tuscon

ELECTRICAL AND MAGNETIC PROPERTIES OF ORGANIC SOLIDS Final Report

Gordon Tollin Nov. 15, 1962 11 p
(Contract AF 19(604)-8475)
(AFCRL-62-1116)

Some of the optical, electrical, and magnetic properties of flavin-phenol complexes have been studied. In addition, the distribution of unpaired spin density in flavin semiquinones has been determined using electron paramagnetic resonance spectroscopy. Author

N63-12756 Princeton U. Frick Chemical Lab., N.J.

RUBBER ELASTICITY OF PRESWOLLEN POLYMER NETWORKS

M. C. Shen and A. V. Tobolsky Jan. 1963 39 p 22 refs Submitted for Publication
(Contract Nonr-1858(07))
(ONR-TR-RLT-57)

The rubber elasticity of lightly crosslinked preswollen polymers is studied by torsion measurements. The equation-of-state of rubber elasticity is applied to evaluate their front factors, which are found to decrease linearly as a function of increasing diluent content. This relation is independent of the crosslinker and the diluent used, provided that the diluent exists in monomeric state. When polymeric diluents are used, the decrease of ϕ becomes much sharper. Properties of deswollen polymer networks are also investigated. Little change is observed before and after deswelling. These results are discussed in the light of the kinetic theory of rubber elasticity. Author

N63-12788 Naval Radiological Defense Lab., San Francisco, Calif.

RAPID RADIOCHEMICAL PROCEDURE FOR ANTIMONY AND ARSENIC

A. E. Greendale and D. L. Love Jan. 17, 1962 14 p 5 refs
(Contract DASA-WEB-10.030)
(USNRDL-TR-607)

A very rapid radiochemical procedure has been developed for antimony and arsenic. A sample is added to a 30-percent solution of H_2SO_4 containing a carrier for antimony or arsenic (or both). This solution is dropped into a flask containing granular zinc at 100° C. The volatile stibine and/or arsine formed is passed through a hot quartz tube and decomposed to the metal, which collects as a metallic mirror on a cooler portion of the quartz tube. This metal is dissolved in H_2SO_4 and assayed. The chemical yield is consistently between 70 and 80 percent. The time required for separation of the metal from the other elements of a fission product solution is about 10 seconds. The decontamination factors for the antimony procedure are: Mixed Fission Products (2 weeks old) = 10^5, I = 3×10^4, Te = 4×10^4 Sn = $>10^5$, AS = 20 - 50. The decontamination factors for the arsenic procedure are: Mixed Fission Products = 10^7, Sb = 2×10^5, Sn = $>10^6$. Author

N63-12799 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

THE PRODUCTS OF FLASH PYROLYSIS OF PHENOL-FORMALDEHYDE BY TIME-OF-FLIGHT MASS SPECTROSCOPY

Henry L. Friedman Sept. 1962 31 p 11 refs
(Contracts AF 04(647)-617 and AF 33(616)-6841)
(R62SD81—Class I)

A sample of phenol-formaldehyde was flash pyrolyzed eleven times in the reaction chamber of a time-of-flight mass spectrometer. Quantitative analyses were determined for pyrolysis products which were present within ten seconds after each flash. A high degree of consistency between compositions of products from consecutive flashes resulted. A discussion of the results is presented. Author

N63-12802 New York U., N.Y.

ADSORPTION AND EXCHANGE ON METAL SINGLE CRYSTALS Final Report, Period Covered: Sept. 1, 1961-Jan. 31, 1963

Cecil V. King Jan. 1963 16 p 10 refs
(Grant DA-ARO(D)-31-124-G116)
(AROD-3156-1)

Exchange studies have been made with electropolished single-crystal specimens of silver and zinc immersed in dilute solutions of their salts, using Ag^{110} and Zn^{65} ions as tracers. In 0.02 M solutions of the salts, exchange in the surface layer of the metals is rapid and complete, and continued tracer pickup is due to diffusion within the crystals. At lower salt concentrations the tracer pickup is slower, apparently because complete exchange is not maintained in the surface layer of atoms. Author

N63-12804 AeroChem Research Labs., Inc., Princeton, N.J.

CHEMICAL SCAVENGER PROBE DETERMINATIONS OF ATOM AND EXCITED MOLECULE CONCENTRATIONS IN NONEQUILIBRIUM SUPERSONIC STREAMS OF ACTIVE NITROGEN

A. Fontijn, D. E. Rosner, and S. C. Kurzius Aug. 1962 70 p 100 refs
(Contract AF 49(638)-300)
(TP-40)

A quartz chemical scavenger probe has been developed to study local active species concentrations in a gas expanded from a converging-diverging nozzle glow-discharge source. The probe samples a small central portion of the supersonic nonequilibrium jet and thus allows direct comparison to other point measurement techniques for determining active species concentrations in the jet, e.g., catalytic detectors. The results obtained with active nitrogen at one relatively low-discharge power output are discussed. The sampled gas mixed and reacted inside the probe with one of the scavenger gases NO, NH_3 or C_2H_4 at 18.8 mm Hg and an average temperature of 500° K. The NO light titration technique and the production of HCN from C_2H_4 set an upper and lower bound, respectively, for the atom concentration. The observed maximum amount of NO decomposition was 2.1 times as large as the NO light titration end-point flow rate. This difference is far in excess of that observed in conventional discharge flow systems and is interpreted as being due to excited N_2 molecules

reacting with NO in a reaction slow compared to that between N-atoms and NO. The contribution of these molecules to the energy content of the jet was found to be at least comparable to that of the N-atoms. A new analytical technique for quantitative analysis of the undecomposed NO was developed. Decomposition of NH_3 also showed the presence of excited molecules; however, since secondary H-atom attack appeared to occur, no calculation of the concentration of these molecules was possible from the NH_3 decomposition data alone. Author

N63-12806 National Bureau of Standards, Washington, D.C.
PYROLYSIS OF NEW FLUOROPOLYMERS
Sidney Straus and Leo A. Wall [1962] 26 p 19 refs Submitted for Publication
(NASA Order R-56)
OTS: $2.60 ph, $0.98 mf

Four new fluoropolymers were pyrolyzed in a vacuum to study rates of volatilization and to identify decomposition products. The polymers thus studied were polyhexafluoropropylene, polyperfluoroheptene, poly-4-chloroperfluoroheptadiene-1,6 and polytrifluorovinylphenyl ether. Poly-4-chloroperfluoroheptadiene volatilized at a rate of approximately 1% per minute at 380° C. There was very little monomer produced on thermal decomposition, and an activation energy of 60 Kcal/mole was obtained on rates at 362°, 374°, and 381° C. Polytrifluorovinylphenyl ether showed a 25% carbonized residue at 500° C pyrolysis. The polymer decomposes into fragments containing very little monomer. Author

N63-12829 Rice U., Houston, Tex.
HYDRATES AT HIGH PRESSURES: METHANE-WATER AND ARGON-WATER SYSTEMS
Donald R. Marshall and Riki Kobayashi Jan. 15, 1962 25 p 17 refs Submitted for Publication
(NASA Grant NsG-6-59)
OTS: $2.60 ph, $0.95 mf

An experimental apparatus has been built to study gas hydrates at pressures up to 100,000 psia. The experimental technique used to determine the hydrate conditions is an indirect method based on the difference in gas content of the solid hydrate and the liquid phase. The system, consisting of the gas and water, is subjected to conditions of temperature at a given pressure which will insure that the system is well into the region of hydrate formation. Then, the temperature of the system is caused to drift at a fixed rate until the temperature passes the hydrate condition. As the hydrate decomposes, the trapped gas is released and then passes into the gas phase, rapidly increasing the system pressure and thus defines the hydrate decomposition curve. Author

08 COMMUNICATIONS

Includes: communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation.

For tracking stations see: 10 Facilities.

For related information see: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation; and 22 Navigation and Guidance.

N63-12495 United Research, Inc., Cambridge, Mass.
LOCALIZATION OF SOUND. PART 2. THE MECHANISM OF HUMAN LOCALIZATION OF SOUNDS WITH APPLICATIONS IN REMOTE ENVIRONMENTS
William B. Mc Lean China Lake, Calif., Naval Ordnance Test Station, Dec. 1962 37 p 10 refs
(Contract N123(60530)27872A)
(NOTS-TP-3109, Pt. 2)

The role of the pinnae, or external ears, in human localization of sounds is briefly reviewed. Additional experiments are described which support the theoretical viewpoint. Subsequent development work to produce aural coupling in both the air and water environments is reported and conclusions drawn from tests made. It has been shown that coupling to both environments is possible using pinnae to introduce the required transformation which depends on relative orientation of sound source and pinna. Understanding the mechanism of localization has provided insight into other related domains, namely, speech recognition and speech intelligibility. These are discussed briefly. Author

N63-12504 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.
A FLIGHT STUDY OF THE EFFECTS OF NOISE FILTERING IN THE ATTACK DISPLAY ON THE PILOT'S TRACKING PERFORMANCE
Howard L. Turner and Donovan R. Heinle Washington, NACA, Sept. 10, 1958 19 p 9 refs
(NACA RM A58E21) OTS: $1.60 ph, $0.80 mf (Declassified)

Flight tests were conducted with a director-type radar fire-control system to determine the effects of various amounts of attack-display smoothing on the pilot's tracking and steering effectiveness in tail-chase and lead-collision beam attacks. Author

N63-12611 Massachusetts Inst. of Tech. Electronic Systems Lab., Cambridge
VENUS RADAR SYSTEMS INVESTIGATIONS Semiannual Status Report, April 1, 1962-September 30, 1962
J. F. Reintjes et al Nov. 1962 71 p 13 refs
(NASA Grant NsG-234-61)
(ESL-SR-157) OTS: $7.60 ph, $2.33 mf

The research being conducted under this NASA Grant is directed toward experiments which will reveal the nature of the core surface of planet Venus. The experiments would make use of electromagnetic-radiation techniques, and the equipment would be aboard a spacecraft. As stated in the preceding semiannual status report, the group is trying to define meaningful mapping experiments which can be conducted in the light of the kinds of trajectories which might be expected and the limitations which a long voyage, such as a Venus probe, places on equipment size, weight and energy consumption. Because of the extraordinary constraints imposed on these items, an effort is being made to develop novel radar subsystems which, hopefully, will make possible the achievement of the low-weight and energy requirements. Specific investigations conducted during the period are reported below. Author

N63-12635 White Sands Missile Range. Inter-Range Instrumentation Group, N. Mex.
PRELIMINARY PLAN FOR GLOBAL TIMING SYNCHRONIZATION
R. E. Rockstrom Oct. 1962 59 p 29 refs
(IRIG 106-62)

An investigation has been made of the need for precise time synchronization on a global basis. It was determined that valid requirements exist for microsecond synchronization. Methods of achieving the required synchronization accuracy were evaluated. Author

N63-12714 TRG Inc. TRG-West Div., Palo Alto, Calif.
A STUDY OF THE WIRE-GRID LENS
M. G. Andreasen Griffiss AFB, N. Y., Rome Air Development Center, July 1962 47 p 5 refs
(Contract AF 30(602)-2742)
(TRG-TDR 1; RADC-TDR-62-363)

A study of some problems important in the design of a circularly symmetric type wire-grid lens is presented. The first problem investigated is that of a double-wire square-mesh grid which will often be used near the rim of the lens to keep the grid-to-grid spacing suitably small. Design formulas for the quasi-static equivalent dielectric constant of such grids have been derived. The validity of these formulas was tested experimentally. Another problem investigated is that of synthesizing the index of refraction in a circularly symmetric lens when the index of refraction is specified in part of the lens and when it is required that the rays leaving the lens must form a collimated beam in as large an aperture as possible. Derived design formulas representing the solution of this problem are most useful for wire-grid lens designs because the grid-to-grid spacing in the outer part of the lens is often determined by mechanical rather than by electrical considerations. Author

N63-12760 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
HIGH POWER PROGRAM. HIGH POWER PROJECT—PROJECT DELILAH Semiannual Report, July 1 through Dec. 31, 1962
L. J. Anderson and L. H. Groth [1962] 81 p 6 refs
(Contract DA-30-069-ORD-2554; ARPA Order 53-59)
(CAL-UB-1309-P-108)

The program for the development of high microwave power levels and for the application of these high power levels for antimissile radar purposes encompasses the following: electron-beam parametric amplifier, data processing, antenna refocusing, cassegrain feed, programed tracker, Delilah Project, cathode current requirement for solid or hollow beams, space charge depression limitations, and single- and multiple-beam klystron. R.C.M.

N63-12815 Collins Radio Co., Dallas, Tex.
C-BAND TRANSPONDER STUDY—PRESENTATION
46 p

Graphic schematic presentations are made of a study of the optimum C-band transponder arrangement for the Apollo spacecraft. M.P.G.

N63-12819 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
SYNTHESIS OF THE FORMS OF ATMOSPHERICS
D. S. Fligel Jan. 4, 1963 32 p 12 refs Transl. from Tr. Nauchn.-Issled. Inst. Zemnogo Magnetizma, Ionosferi, i Rasprostraniya Radiovoln, Akad. Nauk, SSSR, no. 17(27), 1960 p 27-49
(FTD-TT 62-1193-1+2+4)

The forms of atmospherics for various distances from the source have been calculated and compared to observed forms. A number of modes and the dependence of effective conductivity of the ionosphere on frequency were considered. An analysis of the phase characteristics of the signals shows that the effective conductivity of the ionosphere during the day can be determined for specific conditions. Good agreement according to all external characteristics was obtained and found to be quantitative in about 50% of the cases compared. R.C.M.

N63-12830 Norwegian Defense Research Establishment, Kjeller
AN ELECTRONIC DECOMMUTATOR FOR SUBCOMMUTATED FM SUBCARRIERS
Arne Ryen Dec. 1962 33 p 3 refs
(NDRE-T-231)

This report describes an all-solid-state decommutator for use in subcommutated FM subcarrier telemetry systems. This decommutator is especially designed for a small number (less than 20) of decommutated channels, and hence does not conform to IRIG Standards. Author

N63-12839 National Aeronautics and Space Administration, Washington, D. C.
OBTAINING DATA FROM SPACE
Edmond C. Buckley *In* AIBS Bulletin, v. 12, no. 5, Oct. 1962 p 64-67 (See N63-12834 06-16)

The ground instrumentation in support of NASA space programs is described, and the operations of the complementary control center facilities and data processing centers are reviewed. The various tracking and command techniques for unmanned earth satellites (Minitrack), lunar and planetary probes requiring midcourse correction (Deep Space Stations), and manned satellites requiring instantaneous tracking (Mercury Network) are described. M.P.G.

09 ELECTRONICS

Includes: circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory.

For related information see: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N63-12358 Connecticut U., Storrs
SENSITIVITY IN SAMPLED-DATA SYSTEMS
D. P. Lindorff [1962] 26 p 4 refs Presented at the IEEE Winter General Meeting, N. Y., Jan. 27-Feb. 1, 1962 Submitted for Publication
(NASA Grant NsG-309-63)
OTS: $2.60 ph, $0.98 mf

The sensitivity of sampled-data systems to plant variations and load disturbance is examined with reference to two fundamental configurations. It is shown that the sensitivity function of a sampled data system containing no continuous feedback is theoretically limited unless the system is permitted to be conditionally stable. Since the limitation imposed by sampling can be removed by continuous feedback, consideration is given to a sampled-data system containing a continuous minor-loop feedback path. A sensitivity function is derived which measures the individual effectiveness of the inner and outer loops in desensitizing the system, thereby providing the basis for a realistic design approach. This sensitivity function is applied to a design example. Author

N63-12572 Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati (Italy)
TUNNEL DIODE FAST DISCRIMINATOR CIRCUIT
F. Pandarese and F. Villa Sept. 5, 1962 13 p 2 refs
(*Its* Nota Interna 158; LNF 62-73)

A fast integral discriminator, employing tunnel diodes arranged in a bridge-like configuration, is examined. Diagrams and characteristics of the circuit are given. Author

N63-12606 General Electric Co. Power Tube Dept., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR REFRACTORY SUBSTRATE COMBINATIONS Scientific Report No. 4
J. H. Affleck and W. T. Boyd Dec. 27, 1962 16 p 18 refs
(Contract AF 19(628)-279)
(AFCRL-63-11)

Cathode life tests are continuing in excess of 10,000 hours. A method has been devised to display the retarding potential characteristic which permits the rapid determination of the work function. Preliminary results using the General Electric partial pressure analyzer to study cathode processing and poisoning are discussed. Author

N63-12608 Case Inst. of Tech. Digital Systems Lab., Cleveland, Ohio

DIGITAL SERVO LOOP GAIN OPTIMIZATION FOR SECOND AND THIRD ORDER SYSTEMS

Roy Waas 1962 100 p 4 refs
(NASA Grant NsG-36-60)
(EDC-1-62-10) OTS: $8.60 ph, $3.20 mf

An optimum loop-gain-frequency function is derived for a continuous linear servo system of second or third order operating with incremental data. A ramp system input is closely approximated by integrating a pulse sequence and using the resulting sequential step function. The difference between the ramp and the system output is taken as error. The error squared integral is used as a criterion of the goodness of approximation of the ramp by the system output and this integral is minimized for second- and third-order linear systems. Digital computer techniques are used to minimize this integral. In both the second- and third-order systems, the functional relationship between the loop gain and frequency which minimizes the error squared integral is found to be linear. Furthermore, the family of linear minimizing functions generated in the third-order case is of the same slope as the second-order minimizing function. It is also shown that by choosing the loop gain and frequency correctly, it is possible to obtain values of the error. Author

N63-12609 Case Inst. of Tech. Digital Systems Lab., Cleveland, Ohio

AN EXPERIMENTAL INVESTIGATION OF A DIGITAL POSITION SERVOMECHANISM INCORPORATING MINIMAL LOGIC

Marion Kosem 1962 114 p 6 refs
(NASA Grant NsG-36-60)
(EDC-1-62-12) OTS: $9.60 ph, $3.62 mf

The data logic of a digital position servomechanism operating as a sampled data system is developed on the criterion of minimal logic. Logical details of the digital system's operations, including that of comparison, digital-to-analog conversion in the forward loop, and analog-to-digital transduction in the feedback loop are presented together with the circuit details of the sampled-data portion of the control system. Author

N63-12638 New Mexico U. Engineering Experiment Station, Albuquerque

A STUDY OF THE ELECTRICAL DIPOLE MOMENT AND THE FAR FIELDS FROM A TRAILING WIRE ANTENNA

R. W. Kulterman June 1962 35 p
(Contract Nonr-2798(01))
(EE-74)

The radiation properties of a trailing-wire antenna have been studied. The antenna is assumed to be a thin center-fed dipole antenna that is either straight, making an angle θ_o with the vertical, or curved in the shape of a catenary. An expression is derived for the equivalent horizontal and vertical dipole moments of the trailing-wire antenna from which the far fields can be computed by standard methods. The equivalent dipole moments are obtained because they are useful in "mode theory." The far fields are calculated directly, no assumptions being made except those necessary to evaluate the integrals in closed form. The far-field patterns obtained in this way are useful in ray tracing. For electrially short antennas, both methods should lead to the same far-field patterns. Author

N63-12642 Polytechnic Inst. Of Brooklyn. Microwave Research Inst., N.Y.

STUDIES IN THE THEORY OF SWITCHING CIRCUITS Final Report

Edward J. Smith July 11, 1962 52 p 12 refs
(Contract AF 19(604)-6620)
(PIBMRI-1043-62; AFCRL-62-915)

A summary of a program concerned with various problems in the theory of switching circuits is given. Specific results include: an improved "Ambit" method for realizing cut-set matrices, the detection of partial symmetry in boolean polynomials, realization of symmetric diode circuits, treatment of combinational relay-diode circuits by matrix and graph theoretic methods, and an improvement in an established technique for minimizing the internal states in an incompletely specified sequential machine. Author

N63-12655 RIAS. Div. of Martin Co., Baltimore

MATHEMATICAL DESCRIPTION OF LINEAR DYNAMICAL SYSTEMS

R. E. Kalman Nov. 1962 76 p 26 refs Presented at the Symposium on Multivariable System Theory, Siam, Nov. 1, 1962 Submitted for Publication
(NASA Contract NASr-103; Contracts AF 49(638)-382 and AF 33 (616)-6952)
(Tech. Rept. 62-18) OTS: $7.60 ph, $2.48 mf

There are two different ways of describing dynamical systems: (1) by means of state variables and (2) by input/output relations. The first method may be regarded as an axiomatization of Newton's laws of mechanics and is taken to be the basic definition of a system. It is then shown (in the linear case) that the input/output relations determine only one part of a system, that which is completely observable and completely controllable. Using the theory of controllability and observability, methods are given for calculating irreducible realizations of a given impulse-response matrix. In particular, an explicit procedure is given to determine the minimal number of state variables necessary to realize a given transfer-function matrix. Difficulties arising from the use of reducible realizations are discussed. Author

N63-12672 Commissariat a l'Energie Atomique, Saclay (France)

PROPRIETE DES JONCTIONS NIP DE SILICIUM. APPLICATION A LA DETECTION DES PARTICLES RELATIVISTES [CHARACTER OF NIP SILICON JUNCTIONS. APPLICATION TO THE DETECTION OF RELATIVISTIC PARTICLES]

Lydie Koch, Jean Messier, and Jean Valin [1961] 18 p 12 refs Presented at the Conference sur l'Electronique Nucleaire, Belgrade, May 1961 In French
(NE/196)

An experiment to measure the energy loss of high-energy particles (protons and mesons with impulses between 0.6 Bev/c and 1.5 Bev/c) while traveling a known thickness of silicon is described. The measurements were made with NIP diodes using silicon of high resistivity, and also using silicon-lithium combinations. First, curves giving the value of the total loss of energy dE/dx as a function of impulse were drawn for mesons and protons. It was found that, for each impulse value, dE/dx was affected by a spectral distribution as a function of n° of the channel of the amplitude selector. Further, dE/dx was found to decrease about 70% for protons, while remaining constant for pi- and et-mesons. Therefore, this method can be used to distinguish mesons and protons having the same impulse. M.P.G.

N63-12676 General Electric Co. Research Lab., Schenectady, N.Y.

SEMICONDUCTOR DEVICE CONCEPTS Scientific Report No. 2A

M. Aven, R. N. Hall, J. H. Racette, J. J. Tiemann, and H. H. Woodbury Nov. 30, 1962 88 p 38 refs
(Contract AF 19(628)-329)
(AFCRL-63-20(a))

The effects of uniaxial compression and of hydrostatic pressure on the direct and indirect tunneling processes in germanium tunnel diodes have been studied experimentally under forward and reverse bias at 4.2° K and compared with Kane's theory. Luminescence from p-n junctions constructed from the mixed crystal $GaAs_{1-x}P_x$ and from GaSb has been studied. Visible red radiation is produced by the former, but at present the efficiency is poor and the junction profile is quite irregular. Author

N63-12677 General Electric Co. Advanced Semiconductor Lab., Syracuse, N.Y.

SEMICONDUCTOR DEVICE CONCEPTS Scientific Report No. 2B

N. Holonyak, Jr., C. V. Bielan, S. F. Bevacqua, F. A. Carranti, B. G. Hess, and S. J. Lubowski Nov. 30, 1962 14 p 4 refs

(Contract AF 19(628)-329)

(AFCRL-63-20(b))

Generation of coherent visible radiation in $Ga(As_{1-x}P_x)$ p-n junctions is described. The conditions for generation of coherent visible radiation, the possibilities of wavelength selection, and the extension to and implications of p-n junction lasers in ternary compounds are presented. The electrical properties of $Ga(As_{1-x}P_x)$ p-n junctions and their considerable potential for use as avalanche and forward regulator diodes, signal diodes, parametric diodes, and stored charge diodes are described. Author

N63-12678 Radio Corp. of America. RCA Labs., Princeton, N.J.

THEORETICAL AND EXPERIMENTAL STUDY OF THE COMBINED HALL-MAGNETO RESISTANCE EFFECT Scientific Report No. 2, November 1, 1961 to October 31, 1962

K. K. N. Chang, P. E. Chase, and H. J. Prager [1962] 45 p 11 refs

(Contract AF 19(628)-262)

(AFCRL-62-918)

A new group of microwave devices based on the Hall-Effect is being sought. Following a preliminary study of a 2-mc amplifier, with an electronic gain of 43 db, a frequency converter at the S-band region of the microwave spectrum was built and gave a conversion loss of 20 to 30 db. Attempts are being made to combine the Hall sample with special materials such as rutile or YIG to achieve better conversion gain by improving the coupling to the r.f. magnetic fields. A novel scheme based entirely on enhanced iteraction between the Hall sample and its associated circuitry was proposed and analytically examined. The first experimental embodiment of this proposed scheme seems to have yielded a small net gain at a frequency of 3730 mc. The report also includes the results of various experiments on microwave Hall-Effect isolators, as well as on fabrication techniques for millimeter wave tunnel diodes. These tunnel diodes have been operated as detectors at a frequency of 55 Gc. An improvement in sensitivity of 25 db as compared to ordinary crystal detectors has been obtained. Author

N63-12684 Commissariat a l'Energie Atomique, Saclay (France)

CODAGE EN TEMPS PAR ECHELLE BINAIRE [COMPUTER METHODS IN TIME BY BINARY STEP]

Jean Thenard [1961] 18 p 3 refs Presented at the Conference sur l'Electronique Nucleaire, Belgrade, May 1961 In French

(NE/207)

The address sequencing used by an electronic memory in a binary type "time of flight" computer was studied. In this type of computer, periodic impulses are received in memory from a chronometer. A buffering operation causes an input impulse to register in memory in what is termed an "in flight" state. Counters are halted during this state and are recalled upon commencement of normal address sequencing. Results of this study show: (1) a switching circuit will have the best chance of operating correctly if the time constants $R_k C_k$, $R_a C_a$, and $R_z C_z$ possess the lowest values possible; (2) the advantage of the presence of a shared resistance of the R_k cathode; and (3) that the exploitation conditions which constitute an extreme test of the switching circuits can be easily computed. M.P.G.

N63-12694 Michigan U., Ann Arbor

PRECISE FREQUENCY SYNTHESIS USING NONPRECISE TUNING COMPONENTS

Thomas Warwick Butler, Jr. (Ph.D. Thesis) Ann Arbor, University Microfilms, Inc., 1962 177 p 30 refs

The effective utilization of nonprecise tuning components in unique techniques for precise frequency synthesis is discussed. Frequency synthesis is the generation of sinusoidal RF signals of precisely-controlled and accurately-known arbitrary frequencies. Nonprecise components which are examined in detail under the several limiting conditions of operation are solid-state devices, such as variable capacitance diodes, ferroelectric capacitors, and controllable inductors. The significance of combining a discrete-frequency reference and an electronically tuned phase-lock oscillator in the generation of precise frequencies is that it is possible to construct a unit whose output frequency can have certain discrete values. The design and construction of a discrete-frequency synthesizer which tunes over a 1-Mc range in 10-kc steps (two significant figures) is carried out to demonstrate the practicability of the proposed technique. The discrete-frequency reference is provided by a five-stage shift-register generator. The shift-register generator is synchronized by a crystal clock which has a long-term frequency stability of one part in 10^5. The spurious output of the synthesizer is at least 50 db below the desired output. The incorporation of the nonprecise components through the use of phase-lock circuitry has made it possible to develop a technique of frequency synthesis which permits the rapid selection of precise frequencies, is adaptable to remote control, may be readily programed, and theoretically is unlimited in frequency range of operation. Author

N63-12697 Polytechnic Inst. of Brooklyn. Microwave Research Inst., N. Y.

FILTERS WITH POLES HAVING EQUAL VERTICAL SPACING

R. I. Disman and S. Deutsch Sept. 24, 1962 27 p 5 refs

(Grant AF-AFOSR-62-295)

(PIBMRI-1077-62)

In the Butterworth criterion for maximally flat low-pass amplitude response, the poles are spaced by equal angles on a unit circle in the left hand s-plane. This configuration does indeed give us a good cutoff in filters but at the expense of the transient response. The poor transient response is due to the poles which approach the j-axis; their specific contributions are described mathematically. The above problem was considered when a filter was needed to give a band-limited output to an input of sampling pulses. It was decided to place the poles on the unit circle, with equal vertical spacing, so as to try to compromise between good cutoff and acceptable transient response. From the pole distribution the following calculations were performed: amplitude response, time delay, impulse responses, and step response. A synthesis was also performed to determine the corresponding circuit configuration. The above calculations were performed for two, three, four, and five reactive element circuits. A Butterworth filter of five reactive elements is compared to a corresponding filter with equal vertically spaced poles with respect to amplitude response, time delay, and transient response. Author

N63-12704 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

MICROPOWER TRANSISTOR LOGIC CIRCUITS

John C. Sturman Washington, NASA, Feb. 1963 71 p 20 refs

(NASA TN D-1462) OTS: $1.75

An analysis of low-power logic circuits suitable for satellite and space-vehicle use is presented. Special attention is given to two basic circuits differing from those normally used in that two transistors alternately clamp the output to the supply voltage or to ground. One circuit is adopted from a high-efficiency multivibrator; the other is an original circuit specifically developed for micropower use. Author

N63-12752 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

A METHOD FOR THE DIRECT TRANSFORMATION OF HEAT ENERGY INTO ELECTRICAL ENERGY

I. K. Vul'feldt Jan. 9, 1963 5 p Transl. of Soviet Patent 140920 (689180/24), Dec. 16, 1960
(FTD-TT-62-759/1+2+4)

A method is developed for directly transforming heat energy into electrical energy without using a power supply from a storage battery. The method, as compared to other known methods for transforming heat energy into electrical energy, is said to permit raising the efficiency and functional reliability of the energy converter as well as decreasing its weight, dimensions, and inertia. A capacitor and a linear inductance are connected into an oscillating circuit that operates at parametric resonance at a frequency half that of the dielectric heating frequency. Basically, the method consists of intermittently heating and cooling the nonlinear electric capacitor. The penetrability of the capacitor's dielectric is a function of temperature so that a change in the dielectric temperature leads to a change in the capacitance of the capacitor. As a result of the change in the capacitance, a variable electric current is excited in the oscillating circuit. B.J.C.

N63-12765 Atomics International, Canoga Park, Calif.

PERFORMANCE OF CESIUM THERMIONIC DIODES OPERATED IN SERIES-PARALLEL CIRCUITS

J. W. Holland Feb. 1, 1963 39 p 8 refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-7661) OTS: $1.00

Electrical power degradation from the operation of many series-parallel circuited cesium diodes in a thermionic reactor must be considered when a nonflattened nuclear power distribution exists over the volume of the reactor core. This experiment measures the loss of power and efficiency due to unequal heat inputs to series- or parallel-connected diodes, and studies the operating characteristics of a multiple-diode system. The results are applied to a specific thermionic reactor configuration with a ratio of maximum to minimum diode heat input of 1.85. The minimum degradation of power and efficiency was found to be 41% and 19%, respectively, at optimized operating conditions. Author

N63-12783 HP Associates, Palo Alto, Calif.

INVESTIGATION OF HOT ELECTRON EMITTER Scientific Report No. 2, Sept. 1, 1962-Nov. 30, 1962

M. M. Atalla, R. W. Soshea, R. C. Lucas, C. H. Fox, D. A. Reid, and V. M. Dowler 1962 21 p 11 refs
(Contract AF 19(628)-1637)
(AFCRL-62-957)

An analysis is presented of the frequency performance of various metal-base hot carrier triode amplifiers which differ only in the type of hot carrier emitter they utilize. The triodes considered are: (1) the SMS, or semiconductor-metal-semiconductor, triode utilizing a Schottky barrier emitter; (2) the space charge limited emitter triode; and (3) the tunnel-emitter triode. The results are compared with the performance of the bipolar germanium junction transistor. It is shown that for all three hot carrier triodes, the maximum gain-band product increases with current density and approaches an asymptotic limit of about $1.4 \times 10^8/S$ which is due to collector limitation, where S is the stripe width in cm. It is further shown, however, that this limit is closely approached at reasonable current density only by the SMS triode. This limit is to be compared with a value of (5 to 12) $10^8/S$ for the germanium transistor. At an emitter current density of 1000 amp/cm^2 and a stripe width of 10 microns, the maximum gain-band products, or maximum oscillating frequencies, are 60 kmc/sec for the SMS triode, 38 for the space charge limited emitter triode, and 10 for the tunnel-emitter triode. Author

N63-12794 Navy Electronics Lab., San Diego, Calif.

SUGGESTIONS FOR DESIGNERS OF ELECTRONIC EQUIPMENT, 1959-1960 EDITION

F. B. Herold June 1962 Repr. edition 45 p 25 refs

This booklet presents a picture of the kind of electronic equipment needed by the military in this nuclear age. The common design faults are outlined and the following design suggestions are given: electrical, mechanical, thermal, maintenance, safety, and man-machine. Human engineering for designers is discussed. R.C.M.

N63-12808 Irco Corp., New York, N.Y.

OPTICAL SCANNING USING ELECTRICALLY-MODULATED MEMBRANE MIRRORS Semi-Annual Technical Report 2. Final Report, Jan. 1962-Dec. 1962

Harry S. Jones, Edgar J. Astwood, and Harold Clarke [1962] 58 p
(Contract Nonr-3649(00); ARPA Order 269, Amendment 1; Proj. Defender)

Optical scanning using electrically modulated membrane mirrors encompassed: (1) membrane casting, (2) membrane casting solution, (3) membrane removal from the water surface, (4) membrane handling, (5) membrane application apparatus, (6) membrane baking, (7) rotary evaporation system for application of metal coatings to the membranes, (8) optical test apparatus, (9) use of the first experimental membrane-mirror assembly, (10) analysis of difficulties experienced with the first experimental membrane-mirror assembly, (11) review of membrane-mirror functional requirements and possible designs, (12) description of the final experimental membrane-mirror assembly, (13) calibration of the potential distribution between deflection electrode segments, (14) voltage distribution between deflection electrode segments, and (15) use of final experimental membrane-mirror assembly. I.v.L.

N63-12831 Massachusetts Inst. of Tech. Research Lab. of Electronics, Cambridge

QUARTERLY PROGRESS REPORT NO. 68 [A REVIEW OF THE RESEARCH ACTIVITIES ON RADIO PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING]

H. J. Zimmermann, G. G. Harvey, and W. B. Davenport, Jr. Jan. 15, 1963 255 p 184 refs
(Contracts DA-36-039-sc-78108 and DA-SIG-36-039-61-G14)

Radio-physics investigations encompass: (1) physical electronics, (2) soft X-ray spectroscopy, (3) X-ray diffraction studies, (4) physical chemistry, (5) biophysical chemistry, (6) microwave spectroscopy, (7) optical and infrared masers, (8) nuclear magnetic resonance and hyperfine structure, (9) microwave electronics, (10) molecular beams, (11) radioastronomy, (12) physical acoustics, and (13) noise in electron devices. Plasma-dynamics investigations encompass: (1) plasma physics, (2) plasma electronics, and (3) plasma magnetohydrodynamics and energy conversion. Communication sciences and engineering investigations encompass: (1) statistical communication theory, (2) process analysis and synthesis, (3) processing and transmission of information, (4) artificial intelligence, (5) speech communication, (6) mechanical translation, (7) linguistics, (8) communications biophysics, (9) neurophysiology, (10) neurology, (11) cutaneous sensory mechanisms, (12) sensory aids research, (13) circuit theory and design, (14) network synthesis, (15) computer research, (16) advanced computation research, and (17) stroboscopic research. I.v.L.

10 FACILITIES

Includes: airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations.

For related information see: 06 Auxiliary Systems.

N63-12414 Bettis Atomic Power Lab., Westinghouse Electric Corp., Pittsburgh, Pa.

PRESSURIZED WATER REACTOR (PWR) PROJECT Technical Progress Report for the period Oct. 24, 1962 to Dec. 23, 1962

J. T. Stiefel et al [1962] 115 p refs
(Contract AT-11-1-GEN-14)
(WAPD-MRP-101) OTS: $2.50

Pressurized water-reactor projects include: (1) core manufacturing, (2) development of seed fuel, (3) shipping port operations, (4) plant decontamination, (5) reactor physics, (6) metallurgy of core materials, and (7) plant modifications. I.v.L.

N63-12562 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE AMES ATMOSPHERE ENTRY SIMULATOR AND ITS APPLICATION TO THE DETERMINATION OF ABLATIVE PROPERTIES OF MATERIALS FOR BALLISTIC MISSILES

Frank M. Hamaker Washington, NASA, Oct. 1960 33 p 10 refs
(NASA TM X-394) OTS: $3.60 ph, $1.19 mf (Declassified)

The atmosphere entry of ballistic missiles was simulated at entrance velocities from 10,000 to 21,500 feet per second and ranges from 640 to 4150 statute miles. The simulated missiles were from 4.5 to 5.4 feet in diameter and weighed from 3150 to 5500 pounds. The measured ablation weight losses are used to estimate the effective heat of ablation. Author

N63-12723 General Electric Co. General Engineering Lab., Schenectady, N.Y.

ION GAUGE CHARACTERISTICS IN AN AEROSPACE SIMULATOR

David H. Holkeboer and Donald J. Santeler Arnold AF Station, Tenn., Arnold Engineering Development Center, Feb. 1963 53 p 2 refs

The purpose of this investigation was to determine the relationship of ion gauge readings to the fundamental gas properties of pressure, density, and molecular incidence rate, and to study a modification of the ion gauge for use in space simulators where directional pressures exist because of large cryogenically-cooled pumping areas. A theoretical analysis of the operation of the ion gauge suggested that a nude gauge senses the density of gas in a vacuum chamber, whereas a tabulated gauge senses the amount of molecular flux incident on the mouth of the tubulation; neither gauge actually measures pressure. Experiments were then conducted with specially constructed gauges in a vacuum system where the gas parameters could be varied individually to check the validity of the analysis. The predicted behavior was obtained with both nitrogen and helium, although some anomalous results were seen in the latter case. The modified ion gauge, also known as the Space Simulation Gauge, is a tubulated gauge incorporating a cryogenic pumping surface to reduce the response to the incident flux of condensible molecules as if the flux were reflected from the wall of the space chamber having cryogenic pumping panels. A means of calculating the proper pumping area within the gauge was developed and applied. The ability to produce the intended reduction in sensitivity was experimentally confirmed, and some effects of gauge geometry were explored. Author

11 FLUID MECHANICS

Includes: boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow, 03 Aerodynamics of Wings and Control Surfaces; 13 Heat Transfer; and 24 Physics, Plasma.

N63-12354 Wisconsin U. Theoretical Chemistry Inst., Madison

KINETIC THEORY OF NON-SPHERICAL MOLECULES, V

J. S. Dahler (Minnesota U.) and C. F. Curtiss Nov. 19, 1962 32 p 9 refs
(NASA Grant NsG-275-62(4180); NSF Grant G-9204)
(WIS-TCI-6, Ser. 2) OTS: $3.60 ph, $1.16 mf

A generalized Boltzmann equation for fluids composed of molecules with arbitrary internal degrees of freedom and which interact according to classical mechanics through arbitrary, noncentral, pair-additive forces is developed using techniques similar to those used by Hollinger and Curtiss. Several special cases are considered: (1) molecules which interact only through impulsive forces of repulsion, (2) molecules for which the only internal degrees of freedom are rotational degrees, and (3) a combination of both special cases. The third special case leads to a Boltzmann equation appropriate to a fluid composed of rigid nonspherical molecules, and provides a firm basis upon which to develop a formal kinetic theory. As a special example, a gas is considered that is made up of rigid, convex, nonspherical molecules with symmetric top mass distributions. Rigorous equations of hydrodynamics are presented for such a fluid. It is shown that the kinetic theory of a dilute multicomponent system of these molecules is formally the same as that for the loaded sphere system recently studied by Dahler and Sather. Finally, it is shown how the methods developed by these authors can be applied to the problems of solving the Boltzmann equation and of calculating the transport coefficients for the nonspherical molecular species considered. Author

N63-12368 Naval Weapons Lab., Dahlgren, Va.

BOUNDARY LAYER ALONG A FLAT SURFACE NORMAL TO A VORTEX FLOW

Ernst W. Schwiderski and Hans Lugt Dec. 20, 1962 35 p 10 refs
(NWL Rept. 1835)

The axisymmetric vortex motion of a viscous fluid over a flat surface is investigated. Paradoxical results obtained by Moore and Goldshtik are resolved. Guided by a useful extension of Prandtl's boundary-layer theory, an appropriate similarity transformation is found which reduces the Navier-Stokes equations to three ordinary differential equations. The solution of the remaining boundary value problem reveals significant properties of vortex flows and explains several phenomena observed in hurricanes. A complete numerical result is displayed. Author

N63-12386 Wisconsin U., Madison

THE BOUNDARY LAYER FLOW OF A NON-NEWTONIAN FLUID NEAR A SPINNING CONE Technical Summary Report

Subhendu K. Datta Nov. 1962 15 p 5 refs
(Contract DA-11-022-ORD-2059)
(MRC-358)

The steady motion of an incompressible inelastic non-Newtonian Reiner-Rivlin fluid near a spinning cone has been studied, and a similarity solution is presented. It has been shown that the flow patterns can be obtained from Srivastava-Jain's work. But the pressure distribution is not the same so that the numerical values of the pressure are given and their variation shown. Author

N63-12434 Stanford U., Calif.

A LINEARIZED THEORY FOR ROTATIONAL, SUPERCAVITATING FLOW Technical Report No. 16

Robert L. Street Oct. 1962 141 p 25 refs
(Contract Nonr-225(56))

This work is concerned with predicting the forces acting on slender bodies, namely hydrofoils and wedges, in rotational, supercavitating flow. Methods are given for establishing not only qualitative but quantitative measures of the effects of rotation in linearized, supercavitating flows. A linearized theory is developed for steady, two-dimensional flow under the assumption that the flow has a constant vorticity throughout. The effects of gravity, viscosity, and

surface tension are neglected. Tulin's original closed-cavity model is employed. A basic assumption of the theory is that the slender body-cavity combination causes only small perturbations in the velocity components of the basic shear flow. The stream function of the rotational flow satisfies Poisson's equation, which is a linear, inhomogeneous, partial differential equation. By using a particular solution of this equation, the linearized, rotational problem is reduced to a problem involving Laplace's equation and harmonic perturbation velocities. The boundary conditions for the perturbation velocities are established from facts known about the body-cavity combination in the supercavitating shear flow. The resulting boundary-value problem is solved by the use of conformal mapping and singularities from thin airfoil theory. Author

N63-12446 Naval Weapons Lab., Dahlgren, Va.

ROTATING FLOWS OF KÁRMÁN-BÖDEWADT AND STAGNATION FLOWS

E. W. Schwiderski and Hans Lugt Dec. 20, 1962 23 p 6 refs (NWL-1836)

The rotating flows of von Kármán and Bödewadt are reexamined on the basis of an extended boundary-layer theory. A complete set of boundary data is found for both problems in accordance with the practical flow models under consideration. Axisymmetric and plane stagnation flows with finite initial velocities are also studied. Author

N63-12478 National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

HEAT TRANSFER IN LAMINAR FLOWS OF INCOMPRESSIBLE FLUIDS WITH $Pr \to 0$ AND $Pr \to \infty$

Ernst W. Adams Washington, NASA, Feb. 1963 42 p 23 refs (NASA TN D-1527) OTS: $1.25

Exact closed-form solutions of the boundary-layer equations can be derived for the Nusselt number Nu(x) at the leading edge $x = 0$ and, in the limits $Pr \to 0$ and $Pr \to \infty$, on the surface $x \geq 0$ of arbitrary bodies in planar uniform flow. Exact and approximate solutions for Nu(x)/Nu(0) in the range of $0 < Pr < \infty$ are compared to the results of the $Pr \to 0$ and the $Pr \to \infty$ methods. It is shown theoretically and confirmed by the numerical results that the $Pr \to 0$ method yields an upper limit for Nu(x)/Nu(0). The presented examples show that the $Pr \to \infty$ method yields a lower limit for Nu(x)/Nu(0) in case of slender bodies. In the cases for which similarity solutions exist, both methods yield the exact solution for $Nu(x)/Nu(x^*)$ where x^* is any reference station. By use of exact stagnation point solutions for $Nu(0)/\sqrt{Re}$, the $Pr \to 0$ and the $Pr \to \infty$ methods may be applied to obtain engineering estimates of the heat-transfer parameter $Nu(x)/\sqrt{Re}$. Author

N63-12485 France. Office National d'Études et de Recherches Aéronautiques, Chatillon-sous-Bagneux

CONDITIONS DE DÉCOLLEMENT DE LA COUCHE LIMITE LAMINAIRE À GRANDE ALTITUDE AUX VITESSES HYPERSONIQUES (SEPARATION CONDITIONS OF THE LAMINAR BOUNDARY-LAYER AT HIGH ALTITUDE AND AT HYPERSONIC SPEEDS)

Roger Michel [1961] 11 p 7 refs In French; English summary

Large separations may occur at high Mach numbers on the body of missiles when the altitude is high enough to have a laminar boundary layer. These separations may be initiated in flight either by the stabilization skirt or by jet pluming. In wind tunnel, such separations have been initiated by step-shaped obstacles or by frustroms of a cone placed at various locations on a cylindrical body at Mach numbers reaching 12. In the tests performed, the effect of the shape of the ogive, just upstream of the cylindrical part, on the development of the boundary layer and therefore on separation was studied. The tests allowed the extension to hypersonic velocities of a separation criterion previously established for moderate supersonic Mach numbers and the checking of its application when there is a heat flow across the wall. The angle-of-attack effects on separation are discussed. Author

N63-12512 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

ANALYTICAL INVESTIGATION OF FUEL-COOLED TURBINE BLADES WITH RETURN-FLOW TYPE OF FINNED COOLANT PASSAGES

Alfred J. Nachtigall and Henry O. Slone Washington, NACA, June 26, 1957 38 p 10 refs (NACA RM E57D03) OTS: $3.60 ph, $1.34 mf (Declassified)

Coolant-flow rates for a turbine rotor blade with return-flow type of coolant-passage configuration formed by fins within a capped blade shell were investigated with both hydrogen and methane fuels as coolants. The investigation was made for a high-altitude supersonic turbojet engine (flight Mach number, 2.5; altitudes, 50,000 and 80,000 ft) with a turbine-inlet temperature of 3000° R. Ranges of coolant inlet temperatures from 100° to 1000° R and coolant inlet pressures from 3000 to 20,000 pounds per square foot were investigated. Author

N63-12526 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

PUMPING CHARACTERISTICS FOR SEVERAL SIMULATED VARIABLE-GEOMETRY EJECTORS WITH HOT AND COLD PRIMARY FLOW

John L. Allen Washington, NACA, Sept. 8, 1954 26 p 11 refs (NACA RM E54G15) OTS: $2.60 ph, $0.98 mf (Declassified)

Eight conical ejectors, simulating various positions of a two-position nozzle with a fixed shroud and an iris nozzle with an iris shroud, were tested on a 1/10-scale fuselage at Mach numbers from 0 to 2.0, diameter ratios from 1.12 to 1.48, and spacing ratios from 0.123 to 0.70. The external stream had no effect on the internal flow. Data at primary temperatures to 3000° R agreed with 800° R data for choked secondary flow and spacing ratios less than 0.5. Relatively poor pumping characteristics resulted as the nozzle area was increased for afterburning because of reductions in either diameter or spacing ratio. An analysis of ejector air-supply requirements for a typical flight plan is presented. Author

N63-12527 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

SIMPLIFIED THEORY FOR DYNAMIC RELATION OF RAMJET PRESSURES AND FUEL FLOW

Herbert G. Hurrell Washington, NACA, Oct. 21, 1957 20 p 6 refs (NACA RM E57I13) OTS: $1.60 ph, $0.80 mf (Declassified)

An analysis of the approximate response of pressure to fuel flow in the ramjet is presented. The response after dead time is treated by the linearized lumped-parameter method. (Only critical or supercritical transient operation is considered.) The theory obtained for this part of the response is a second-order lead-lag, the time constants being dependent on the shock dynamics and the ratios of the significant volumes to the steady-state volume flow rate. The calculation of the dead time in the response is based on sonic propagation of the pressure disturbance through steady flow. For both parts of the response the theory is compared with experimental data. Author

N63-12601 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham

ROTATING STALL IN THE ELEMENTARY STAGE OF AN AXIAL COMPRESSOR, OR IN A SINGLE STAGE AXIAL COMPRESSOR (VRASHCHAYUSHCHIISYA SRYV V ELEMENTARNOI STUPENI OSEVOGO KOMPRESSORA)

V. N. Ershov and G. V. Pavlenko Dec. 1962 10 p 4 refs Transl. from Izv. Vysshikh Ucheb. Zavedenii. Aviats. Tekh. (USSR) v. 3, 1959 p 64-71 (TIL/T-5379)

A method of analysis is developed that uses the variational principle of maximum flow of mechanical energy as a criterion to separate the stable forms of motion. The propagation velocity of the stall zone is also found analytically. Author

N63-12604 Brown U. Div. of Engineering, Providence, R.I.
PHOTOIONIZATION UPSTREAM OF A STRONG SHOCK WAVE
Carlo Ferrari and Joseph H. Clarke Jan. 1963 43 p 23 refs
(Contract NOw 62-0604-c; Proj. Polaris and Proj. Defender)
(CM-1020)

Explicit gasdynamic equations for unsteady, rectilinear motion are deduced from the statistical mechanics for an ionizing and radiating gas, when both of these processes are out of equilibrium. An estimate is then given of the degree of ionization produced upstream of a strong normal shock wave by radiation from the hot nonequilibrium region downstream of the shock. Results of the theory and estimate are compared with experiments and interpreted in terms of relevant mean free paths. Author

N63-12652 Cornell Aeronautical Lab., Buffalo, N.Y.
THE EFFECT OF AMBIENT DISSOCIATION AND SPECIES DIFFUSION ON NONEQUILIBRIUM SHOCK-LAYERS
Walter Gibson N.Y., Inst. of the Aerospace Sciences [1963] 109 p 39 refs Presented at the IAS 31st Annual Meeting, N.Y., Jan. 21-23, 1963
(NASA Contract NASr-19)
(IAS Paper 63-70) IAS: $0.50 members, $1.00 nonmembers

The effects of ambient dissociation and species diffusion are analyzed for nonequilibrium shock layers. A simple correlation (subtraction rule) is established to account for ambient dissociation in inviscid flows. This correlation applies when the oxygen-nitrogen ratio of the dissociated free stream has been properly adjusted. Implications of this result are noted in connection with simulation of real-gas effects in high-enthalpy wind tunnels. Analytic and numerical solutions are obtained for species diffusion behind strong shocks. The subtraction rule is extended to flows including diffusion. Author

N63-12692 Ohio State U., Columbus
A THEORETICAL ANALYSIS OF TRANSPIRATION COOLING IN LAMINAR AND TURBULENT BOUNDARY LAYERS AND CHANNEL FLOWS
Michael Chen-Chiang Fong (Ph. D. Thesis) 1961 135 p 27 refs

This theoretical analysis is confined to studies of the velocity profile and the skin friction as well as the heat transfer characteristics of a transpiration-cooled surface. Emphasis is placed on the theoretical aspect of the fundamental problems involving fluid injection at the surface. A critical review of the mathematical approach is presented. The discussion is restricted to the case of gas injection. With some modifications, the method of solution of the transpiration-cooling problems presented is believed to be valid for cases involving evaporation or sublimation. B.J.C.

N63-12729 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
NUMERICAL METHODS IN GASDYNAMICS
A. A. Dorodnitsyn Oct. 24, 1962 21 p 14 refs Transl. from Arch. Mech. Stosowanej (Poland), v. 12, no. 1, 1960 p 13-27
(FTD-TT-62-979/1+2+4)

Numerical methods, using high-speed computers, for solutions to problems of gasdynamics are discussed. Results indicate that: (1) The use of partial differential equations, developed for continuous and smooth functions, was ineffective. (2) In construction of a finite-difference approximation for partial differential equations involving discontinuous solutions, each network mode must be considered a possible point of discontinuity. The relationship between the quantities for the discontinuity must be taken in accordance with the integral conditions of conservation, i.e., to take these relations as exact and in such a manner as to ensure the prescribed accuracy of the calculation. (3) The method of approximate reduction of partial differential equations to systems of ordinary differential equations is effective for boundary-value problems where the order of the approximate system of ordinary equations is low. (4) When calculating by the method of characteristics, it is advisable to use series in the construction of the initial element of the shock wave. It can be concluded, that, although high-speed computing can solve almost any two-dimensional problem, many fundamental difficulties as well as computation difficulties must be resolved before three-dimensional problems of any complexity can be solved. I.v.L.

N63-12737 Bettis Atomic Power Lab., Westinghouse Electric Corp., Pittsburgh, Pa.
A SMALL PERTURBATION APPROACH TO THE STUDY OF PARALLEL CHANNEL BOILING FLOW OSCILLATIONS
J. E. Meyer and E. A. Reinhard Jan. 1963 41 p 6 refs
(Contract AT-11-1-GEN-14)
(WAPD-TM-342) OTS: $1.00

A method is discussed for treating oscillations in flow through a heated boiling channel which connects two plenum regions of constant pressure difference. The method is based on linearizing equations representing conservation laws in the fluid. The resulting linearized equations are used to determine system response to small perturbations by using standard matrix techniques to form the characteristic equation of the system and to determine its characteristic roots or eigenvalues. The method can be used for spatially varying heat flux, and for flow with and without slip. Author

N63-12749 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
REPLY TO COMMENTS BY EMRICH AND GION
Herman Mark and Michael J. Mirtich, Jr. Repr. from Phys. Fluids, v. 5, no. 11, Nov. 1962 p 1488 2 refs

This paper refutes suggestions of Emrich and Gion (*Phys. Fluids 5*, 1486, 1962) that data presented in a previous work of the authors (H. Mark and M. J. Mirtich, Jr., *Phys. Fluids 5*, 251, 1962) for increasing transition times can possibly be explained by the existence of a "bump" or disturbance on the shock-tube walls. The authors contend that since there was no pattern to the possible "bump" locations and since the transition was traveling at close to particle (or contact surface) speed, the receding contact surface was the most probable disturbance factor responsible for the transition when sufficiently close to the transition. Once the contact surface has receded sufficiently, the transition then travels at shock speed. B.J.C.

N63-12757 North Carolina State Coll., Raleigh
THE APPLICATION OF THE TRACER DISPLACEMENT TECHNIQUE TO THE STUDY OF NON-NEWTONIAN FLUIDS Final Technical Summary Report
F. M. Richardson Jan. 16, 1963 12 p 10 refs
(Contract DA-36-034-ORD-2477)
(AROD-1830-1)

The tracer displacement technique has been shown to be applicable to the determination of velocity profiles and rheograms for non-Newtonian fluids. Observations have been made in a number of materials, and the kinds of interpretations which can be made have been explored. Modifications bringing about greater flexibility and precision have been designed and planned. Work has advanced to the point where particular phenomena can be studied, e. g., wall effects, transition flow, and two-phase flow. A modification of the technique is being considered for *in situ* activation of a tracing constituent in liquids during steady flow. R.C.M.

N63-12764 Diamond Ordnance Fuze Labs., Washington, D.C.
FLUID AMPLIFICATION. 4. GAIN ANALYSIS OF THE PROPORTIONAL FLUID AMPLIFIER
S. J. Peperone, Silas Katz, and John M. Goto Oct. 30, 1962 43 p 4 refs
(TR-1073)

A theoretical analysis of signal gain using principles of fluid stream interaction is presented. This analysis is applied to predict pressure, flow, and power gains of a fluid amplifier and to determine optimum operating conditions and geometry. Comparison of theory and measurements shows agreement within the experimental error. Author

N63-12767 Pennsylvania State U. Coll. of Mineral Industries, University Park

COMPUTATION OF KINETIC CONSTANTS FROM SINGLE-PULSE SHOCK TUBE DATA

Bruce E. Knox, Edward T. Mc Hale, and Howard B. Palmer Charlottesville, Va., U. School of Engineering and Applied Science, Jan. 1963 11 p 6 refs Submitted from Publication
(Contracts Nonr-1858(25) and Nonr-3623(00); Proj. SQUID)
(Tech. Rept. PSU-9-P)

Recent work in computing kinetic constants from single-pulse shock-tube data, using the tailored-interface method to extend the available time, indicates that slightly overtailoring the initial tube conditions is the best approach. Equations are presented showing how the reaction of the change in concentration of A, established as essentially of the nth order in A and of the mth order in M, can be integrated and written in general form. As an illustration, the case for a reaction that is first order in A is solved, considering region 5 and rarefaction separately. This calculation for hydrazine decomposition in a single-pulse shock tube was programed for an IBM 7074 computer. M.P.G.

N63-12797 Instituto Aerotécnico, Córdoba (Argentina)

MÉTODOS DE MEDICIÓN DE CAPA LÍMITE Y ESTELAS EN FLUJO SUPERSÓNICO, REFIRIÉNDOSE A CONDICIONES EXISTENTES EN EL TÚNEL SUPERSÓNICO DEL INSTITUTO AEROTÉCNICO [METHODS FOR MEASURING BOUNDARY LAYERS AND WAKES IN SUPERSONIC FLOW, REFERRING TO EXISTING CONDITIONS AT THE SUPERSONIC WIND TUNNEL OF THE INSTITUTO AEROTÉCNICO]

José E. A. de Krasinski [1962] 34 p 26 refs In Spanish; English summary
(*Its* Communicaciones e Informes, Publicacion Tecnica T-6)

This report is a summary of various experimental and theoretical data which are useful for measuring boundary layers and wakes in supersonic flow. Current methods are also shown to reduce numerically the experimental results. Author

N63-12822 Stanford Research Inst., Menlo Park, Calif.

COLLISION LIFETIMES AND THE THERMODYNAMICS OF REAL GASES

Felix T. Smith [1962] 25 p 7 refs Submitted for Publication
(NASA Contract NASr-49(07))
OTS: $2.60 ph, $0.95 mf

The perfect gas law, $p/kT = n = \Sigma_i n_i$, (where n_i is in molecules per cm^3) is inadequate for describing real gases because of the interactions during collisions. These interactions can be taken into account exactly, if the collision lifetimes are known. The product of collision rate and lifetime gives the concentration of transient collision complexes, which must be considered in the perfect gas law along with the stable species. As a result, the complete virial expansion is obtained, in both quantal and classical mechanics. The argument leads further to a new form for the partition function which includes the continuum as well as bound states. From this, all of the thermodynamic functions can be obtained. Author

12 GEOPHYSICS

Includes: auroral phenomena; upper atmospheric studies; cartography; geodesy; and geomagnetism.

For Van Allen belts see: 28 Space Radiation.

For related information see: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N63-12379 Michigan U. Space Physics Research Lab., Ann Arbor

THE DUMBBELL ELECTROSTATIC IONOSPHERE PROBE: IONOSPHERIC DATA

L. H. Brace Sept. 1962 148 p 35 refs
(NASA Contract NASw-139; Contracts AF 19(604)-6124 and DA-20-018-509-ORD-103; ORA Projects 02816-1, 03484, and 03599)
(Sci. Rept. JS-3) OTS: $11.00 ph, $4.64 mf

The Dumbbell probe theory is reviewed briefly, and several predicted volt-ampere characteristics are presented. Experimental characteristics, recorded in flight, are found to agree well with those predicted by the theory. The methods by which the theory is used in the reduction of electron temperature and positive ion density from volt-ampere characteristics are discussed. The ionosphere data from four daytime flights and one nighttime flight to over 300 kilometers are presented and discussed. It is concluded that the electron temperature in the quiet midlatitude ionosphere is generally higher than currently accepted gas temperatures in the lower F-region, but that thermal equilibrium is approached in the upper F-region and in the E-region. The electron temperature appears to be directly related to the latitude and the level of solar activity, although it is difficult to separate these effects. "Spread F" in the auroral zone is associated with strong fine structure in the temperature and density profiles. Magnetic storm activity at lower latitude is accompanied by high electron temperature throughout the ionosphere, especially in the E-region and upper F-region, where lower electron temperatures prevailed under quiet conditions. The good agreement between the nighttime electron temperature and the reference atmosphere nighttime gas temperatures demonstrates the validity of the Dumbbell technique for ionosphere temperature measurement, while good agreement of the Dumbbell-derived ion densities and the electron densities measured simultaneously by two-frequency beacon and ionosonde techniques demonstrates the validity of the Dumbbell charge density measurements. A comparison of daytime and nighttime temperatures indicates a 35% to 70% total diurnal variation can be expected in the quiet F-region. A comparison of the electron and positive ion density, measured simultaneously in the lower ionosphere, shows that the negative ion population in the D- and lower E-regions is larger and occurs at a higher altitude than is generally predicted by theory. Author

N63-12415 Mc Gill U., Montreal (Canada)

PROJECT H A R P (HIGH ALTITUDE RESEARCH PROGRAM) Description and Status

[1962] 57 p 22 refs
(Rept. 62-5)

Facilities for a high altitude research program (Project HARP) are being constructed on Barbados Island. These facilities include mountings for 4-in. and 16-in. guns which will launch ballistic probe vehicles, optical recording equipment, and a modified M-33 radar. Two prototype Martlet I probe vehicles (gas seeding vehicles for the 100-km altitude range) have been built and instrumented with transmitters, lateral accelerometers, and special smoke tracers that will emit a continuous column of smoke along the entire trajectory of the vehicle. The design of the Martlett II vehicle (for intermediate altitudes up to 150 km) is nearing completion, and general range operation procedures are being developed. M.P.G.

678927 O - 63 - 3

N63-12467 Adelaide U. (Australia)
ON THE VARIATION OF RADIO STAR AND SATELLITE SCINTILLATIONS WITH ZENITH ANGLE
B. H. Briggs and I. A. Parkin Dec. 1962 33 p 27 refs Submitted for Publication

The theory of the variation of the depth of amplitude scintillations with the zenith angle of the source is considered for radio waves received from a star or a satellite. It is assumed that irregular phase fluctuations are impressed on the wave in traveling through the ionosphere, and that the amplitude fluctuations develop by a diffraction process as the wave propagates in the free space beneath the ionosphere. Two effects are produced by an increase in the zenith angle of the source. The magnitude of the phase perturbations increases because the thickness of the ionosphere along the line of sight increases, and the geometry of the diffraction process changes. Theoretical results are given, both for isotropic irregularities and for irregularities elongated along the direction of the earth's magnetic field. The advantages of observing simultaneously on two wavelengths are stressed. Some comparisons with available experimental data are made, and suggestions are made for future experiments. Irregularities at different distances from the observer are not equally effective in producing amplitude scintillations, and some examples of the "weighting function" which determines their effectiveness are given. Various measures of "scintillation depth" are discussed and related to each other. Author

N63-12614 Ohio State U. Inst. of Geodesy, Photogrammetry and Cartography, Columbus
STUDIES ON THE ACCURACY OF THE COMPUTATION OF GRAVITY IN HIGH ELEVATIONS
Helmut Moritz 1962 37 p 11 refs Repr. from Ann. Acad. Sci. Fennicae, Ser. A, III, Geologica—Geographica (Helsinki), no. 59
(Contract AF 19(604)-6201)
(Isostatic Inst. of Intern. Assn. Geodesy Publ. No. 38) Available from Isostatic Inst., Suomi, Helsinki, Aurorank. 7: $1.50

It is necessary in checking airborne gravimetric surveys not only to compute high-elevation gravity values from gravity measured on the earth's surface, but also to know the accuracy obtainable. A general theory of accuracy of these computations is sketched and numerical values given. The central conception is the covariance function C(s). After the theoretical foundations are summarized, some detailed investigations concerning different computational methods are given. The errors arising from representation, interpolation, and from replacing the integrals by sums are studied, and, finally, a possibility of computing the influence of topographical irregularities and of the neglected outer zones is outlined. Author

N63-12631 Queensland U., Brisbane (Australia)
FURTHER RESULTS OF OBSERVATIONS OF FIELD-ALIGNED IRREGULARITIES FROM BRISBANE Scientific Report No. 12
Evelyn M. Matthew Mar. 1962 141 p 22 refs
(AF 64(500)-9)
(AFCRL-62-349)

Results of an investigation into the characteristics and behavior of echoes from F-region field-aligned irregularities (F.A.E.'s), as observed at 16 Mc/s from Brisbane (geomagnetic coordinates 35°08'S, 226°09'E), over the period August 1960 to August 1961, are discussed. The echoes (classified as patch or U-echoes) were observed either by direct reflection (short-range echoes—up to 2000 km from Brisbane) or as long-range echoes (at ranges from about 2000 to 4500 km from Brisbane), either by intervening reflections from the F-region and ground or by direct reflection at times of steep horizontal ionospheric gradients (Dearden, 1962). The diurnal variation of F.A.E. occurrence was related to prevailing ionospheric conditions, long-range echoes occurring at times when f_0F_2 is high and h'F is low, and short-range echoes when f_0F_2 is low and h'F is high. U-echoes typically showed azimuthal spreads 20° greater than those of patch echoes. U-echoes were found to occur preferentially at times of magnetic disturbance; magnetic control of sense of motion (northwards with increasing magnetic disturbance), and of range-spread (decreasing with increasing disturbance) was observed. There was a possible correlation between F.A.E. occurrence and that of radio-star scintillations, and of visual aurorae. The results were not inconsistent with the occurrence of regions of greater reflectivity within a continuum of field-aligned irregularities, the actual observed echo shapes being related in some way to the dimensions of these regions. Author

N63-12645 National Bureau of Standards. Central Radio Propagation Lab., Boulder, Colo.
THERMAL BALANCE IN THE F REGION OF THE ATMOSPHERE
Douglas C. Hunt Sept. 1962 90 p 45 refs
(NBS-TN-162) GPO: $0.50

An investigation is made of thermal mechanisms and detailed properties of the atmosphere at F-region heights. The method used constructs a thermal model of the atmospheric F-region based on experimental data combined with theoretical results and arguments. The heat balance equation for this model is simultaneously solved with the barometric equation. The resultant mass density profiles are then compared with observed mass density profiles to determine how much heating by some external source is necessary in the F-region. Two cases are considered, one in which the time rate of change of temperature is zero (quasi steady state) and one in which it is not zero (nonsteady state). In the first case, a complete solution is obtained. In the second case, only a first approximation is carried out. It is concluded that a heat flux of 1.13 ergs/cm²-sec, originating in solar electromagnetic radiation, can satisfy the thermal requirements of the atmospheric F-region. The existence of other heat sources cannot be excluded altogether but their necessity is ruled out. For a 1.13 ergs/cm²-sec electromagnetic radiation heat flux, a model of height and time variation of pertinent atmospheric parameters is constructed. These parameters are the temperature, molecular weight, scale height, detailed composition, optical depths, rate of heat generation due to absorption of solar electromagnetic radiation, rate of radiative heat loss, and the thermal conductivity. The effect of varying the parameters that determine the importance of the terms in the heat balance equation, and of varying the boundary conditions is tested. It is concluded that the uncertainties in these quantities cannot seriously affect the results obtained. Author

N63-12649 Southwest Center for Advanced Research, Dallas, Tex.
INTERPRETATION OF K_p INDEX AND M-REGION GEOMAGNETIC STORMS
A. J. Dessler and J. A. Fejer Jan. 24, 1963 21 p 27 refs Submitted for Publication
(NASA Grant NsG-269-62)
OTS: $2.60 ph, $0.83 mf

It is argued that the traditional interpretation of the K_p index is no longer tenable. The K_p index, generally taken to be a measure of the strength of the solar-wind flux, may be more acceptably interpreted as a measure of the time rate of change of the sum of plasma plus magnetic pressure acting on the magnetosphere. The stability of the magnetospheric surface in the solar wind is demonstrated theoretically when reasonable assumptions are made for the plasma density just inside the magnetosphere. The magnetic irregularities that have been observed outside the magnetosphere do not appear to be hydromagnetic waves, but most likely are quasi static irregularities that are swept past the detectors by the solar-wind flow. As a corollary to this new interpretation of K_p, it is proposed that M-region geomagnetic storms are due to sheets of turbulence or irregularities that are generated by the collision of a region of high solar-wind velocity with a low-velocity region. Author

N63-12658 Ohio State U. Inst. of Geodesy, Photogrammetry and Cartography, Columbus
ON THE STATISTICAL ANALYSIS OF GRAVITY ANOMALIES

R. A. Hirvonen 1962 37 p 11 refs Repr. from Ann. Acad. Sci. Fennicae, Ser. A, III, Geologica—Geographica (Helsinki), no. 58 (Contract AF 19(604)-6201)
(Isostatic Inst. of Intern. Assn. Geodesy Publ. No. 37) Available from Isostatic Inst., Suomi, Helsinki, Aurorank. 7: $1.00

Research on the statistics of gravity anomalies is continued. New and independent methods for computing the statistical functions E_s and G_s are described. E_s, the error of representation, can be obtained using a map with iso-anomaly curves. G_s, the root mean square anomaly, may be computed if the covariance function, C_d, is given empirically. The formulas are illustrated by a numerical example. The continuation of the gravity anomaly field to different elevations is discussed. An earlier integral formula, expressing the gravity anomalies in terms of those at ground level, can be simplified and adapted for electronic computing. For manual computation, the statistical method described above is used to find a template which gives satisfactory accuracy with the least amount of labor. Author

N63-12659 Ohio State U. Inst. of Geodesy, Photogrammetry and Cartography, Columbus
HARMONIC ANALYSIS OF WORLD-WIDE GRAVITY MATERIAL
U. A. Uotila 1962 21 p 15 refs Repr. from Ann. Acad. Sci. Fennicae, Ser. A, III, Geologica—Geographica (Helsinki), no. 60 (Contract AF 19(604)-6201)
(Isostatic Inst. of Intern. Assn. Geodesy Publ. No. 39) Available from Isostatic Inst., Suomi, Helsinki, Aurorank. 7: $1.50

Corrections for the international theoretical gravity formula were computed using the least squares method on mean free-air anomalies of 8759 1° × 1° blocks in the Northern Hemisphere and 2535 blocks in the Southern Hemisphere. The new free-air anomaly solution gives almost the same location for the major axis of the earth, but the ellipticity is smaller. The flattening value obtained, 1/298, agrees with other sources; the term A_{20} is larger than the value obtained from satellite data. The results strongly suggest that the flattening is different for the Northern and Southern Hemispheres, and agree with the idea of a pear-shaped earth proposed by O'Keefe. Therefore, the outlook is unfavorable for applying gravity anomalies obtained on the Northern Hemisphere to the large unsurveyed part of the Southern Hemisphere. Also, triaxiality appears to be the result of mathematical treatment rather than of reality. M.P.G.

N63-12702 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL OF THE QUIET IONOSPHERE
J. Carl Seddon Washington, NASA, Feb. 1963 14 p 13 refs (NASA TN D-1670) OTS: $0.50

Analysis of high-altitude-rocket electron and ion density measurements suggests a simple model of the quiet ionosphere. Near $h_{max}F_2$ the profile is given by the "α-Chapman" function, that is, the Chapman electron density equation with sec $\chi = 1$ and the scale height H a constant. A method is given for determining $h_{max}F_2$, $N_{max}F_2$, and H from N(h) data obtained from ionograms. Well above the peak, the profile is taken to have a constant exponential slope of 200 km during the day and 150 km at night. If simultaneous nearby measurements of the total electron content are available, a more accurate slope may be computed to provide the profile up to about 1000 km altitude. Author

N63-12732 Columbia U. Lamont Geological Observatory, Palisades, N.Y.
NUMERICAL INVERSION OF SEISMIC SURFACE WAVE DISPERSION DATA AND CRUST-MANTLE STRUCTURE IN THE NEW YORK-PENNSYLVANIA AREA
James Dorman (NASA Goddard Inst. for Space Studies) and Maurice Ewing Dec. 1962 17 p 15 refs Repr. from J. Geophys. Research, v. 67, no. 13, Dec. 1962 p 5227-5241
(Contracts AF 19(604)-8375 and AF 19(604)-7376)
(*Its* Contribution 580; AFCRL-63-219)

A least-squares curve-fitting program in which calculations of surface wave dispersion are used has been developed in order to compute an interpretation of empirical dispersion data in terms of a layered model of the earth. Input may consist of dispersion data (phase velocity versus wave period) for both Love and Rayleigh waves in any modes of propagation. Output consists of successive approximations of the values of parameters such as layer thicknesses, shear velocites, and densities which minimize the mean square of residuals of the empirical data with respect to theoretical dispersion curves calculated from the parameters. Tests made by applying the method to precisely computed theoretical dispersion curves demonstrate the validity of the method. In these, as many as six parameters of the original theoretical models are calculated under a wide variety of conditions from the dispersion data only. In other cases, the amount of information obtainable may be greater or smaller, depending on the quality of the input data. The New York-Pennsylvania dispersion data of Oliver et al. [1961] can be successfully interpreted by using additional information from seismic refraction and studies of nearby earthquakes in the area. A solution including the important effect of the mantle low-velocity channel gives a crustal thickness of 38.6 km, a crustal shear velocity of 3.64 km/sec, a shear velocity of 4.685 km/sec below the M discontinuity, and a ratio of 2.86/3.30 between crustal and subcrustal density values. The density measurement is a new result. The shear velocity structure derived here is consistent with results obtained by Katz from seismic refraction profiles in the same area. Additional data are needed in order to derive more detailed information on crustal structure. Author

N63-12759 Massachusetts Inst. of Tech., Cambridge
ATMOSPHERIC MOMENTUM AND ENERGY CALCULATIONS FOR THE SOUTHERN HEMISPHERE DURING THE IGY Scientific Report No. 6
Godwin Olu Patrick Obasi Jan. 1, 1963 367 p 84 refs
(Contract AF 19(604)-6108)
(AFCRL-62-1128)

Using I.G.Y. data, tabulations of daily winds were made at eight pressure levels (850, 700, 500, 400, 300, 200, 100 and 50 mb) for 121 Southern Hemisphere plus 22 Northern Hemisphere equatorial stations during the calendar year 1958. The data permitted a study to be made by seasons of the mean meridional and mean zonal circulation, the angular momentum balance, surface frictional stresses, and the rate of generation of the mean zonal kinetic energy. Author

N63-12770 Geophysics Corp. of America, Bedford, Mass.
MODIFICATION OF THE EARTH'S UPPER ATMOSPHERE BY MISSILES Final Report
J. Pressman, W. Tank, J. Connell, H. K. Brown, W. Reidy, A. Dalgarno, S. Millman, and P. Warneck Dec. 1962 64 p 7 refs
(ARPA Contract SD-112; ARPA Order 286-62)
(GCA-TR-62-18-G)

Abstracts of scientific papers resulting from a study of the modification of the earth's upper atmosphere by missiles are presented. The data compiled in this study indicate the strong probability that an accelerated rocket program may cause future local or widespread modifications of the upper atmosphere. These modifications include changes in composition, temperature structure, light emission, electron density, and airglow. A theoretical program to evaluate this problem is presented. R.C.M.

N63-12773 Royal Technical U. of Denmark. Ionosphere Lab., Copenhagen
OBSERVATIONS OF VLF RADIO NOISE AT GODHAVN, GREENLAND Technical (Final) Report No. 12
Eigil Ungstrup (Ph. D. Thesis) Sept. 1962 116 p 27 refs
(Contract AF 61(052)-298)

Audiofrequency radio noise in the band from 0.5 to 15 kc/s has been recorded at Godhavn, Greenland (geogr. 69° 15.5'N, 53° 30' W, geomag. 79.9° N, 32.6 E) since July 19, 1957. Equipment

improvement included moving the antenna further away from the ionosphere station, which resulted in a reduction in interference level and the use of a transistorized preamplifier which resulted in an increased sensitivity of the order of 16 db. The data taken from the start of the recordings and to the end of 1961 have been treated, and the occurrence of whistlers and the type of ionospheric noise named chorus have been studied. Results indicated that: (1) The seasonal occurrence of whistlers peaks during the winter in accordance with observations made at other high latitude stations. (2) The diurnal occurrence of whistlers observed is abnormal as compared to stations at low and high latitudes. (3) All whistlers seem to be short whistlers. (4) The seasonal occurrence of chorus peaks during the summer with the activity virtually dropping to zero during the winter. This agrees with observations made at the South Pole but not with observations made at stations located outside the auroral zones. (5) The diurnal occurrence peaks about 10 local meantime in agreement with other polar cap stations. Inside the auroral zones the time of the peak scarcely varies with magnetic latitude which is contrary to the findings from the stations located outside these zones. And (6) The chorus at Godhavn occurs in the frequency range 500 c/s to 1500 c/s and shows a negative correlation with magnetic activity. I.v.L.

N63-12789 Alberta U., Edmonton (Canada)
SEISMOLOGICAL MEASUREMENTS IN SOUTHERN ALBERTA, 1962 Final Report No. 1
G. L. Cumming, G. D. Garland, and K. Vozoff Nov. 30, 1962 46 p 10 refs
(Contract AF 19(604)-8470; ARPA Order 180-61, Amendment 2) (AFCRL-62-1121)

Refraction arrivals from chemical explosions observed along an east-west profile 250 kilometers long in southern Alberta are analyzed. The line determined by arrivals identified as the wave refracted at the Mohorovicic discontinuity is consistent with a depth between 44 and 48 km. for this interface. The depth depends on the crustal model chosen. Reasons are given for favoring a crust containing material with velocities of 6.4, 6.1, and 7.3 km./sec., with the Mohorovicic discontinuity at a depth of 48 kilometers. Comparisons are made between the amplitudes obtained with contained and uncontained charges. Magnetotelluric measurements from the area are discussed from the point of view of possible discontinuities in electrical properties at the seismological boundaries. Author

N63-12790 Columbia U. Lamont Geological Observatory, Palisades, N.Y.
GEOMAGNETIC OBSERVATIONS ON FLETCHER'S ICE ISLAND (T-3), ARCTIC OCEAN Scientific Report No. 5
James C. G. Walker Nov. 1962 13 p 9 refs
(Contract AF 19(604)-7442)
(AFCRL-62-1088)

Measurements of the geomagnetic field made at magnetic latitude 69 N during the late summer of 1961 are described. The temporal behavior of the field is discussed, along with the mean daily variation of the total intensity and some properties of the one- to thirty-minute fluctuations. Author

N63-12828 Geoscience Inc., Lexington, Mass.
DEEP RESISTIVITY INVESTIGATION IN NEBRASKA
T. Cantwell and E. N. Dulaney Dec. 1962 29 p 4 refs
(Contract AF 19(628)-2351)
(Sci. Rept. 2-2351; AFCRL 62-959)

During November 1962, a series of deep resistivity measurements were made near Auburn, Nebraska. Field measurements were made using dipole-dipole geometry with dipole lengths from 100 feet up to 2 miles. Dipole separations up to 12 miles were used with a current into the ground of 0.5 amps. The upper layer has a resistivity of 15 to 20 ohmmeters, making the average resistivity of the hidden basement 150 to 200 ohmmeters. Consideration of the known geology places an upper limit of 800 to 1000 ohmmeters on the hidden layer resistivity that might cause deviations from the assumed model. The pre-Cambrian basement is not suitable for deep strata communication for the upper kilometer, and there is no evidence for an increase in resistivity below this point. Author

13 HEAT TRANSFER

Includes: ablation; cooling; heating; and other thermal effects.

For aerothermodynamics see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings and Control Surfaces.

For combustion see: 26 Propellants and Combustion.

For related information see: 11 Fluid Mechanics.

N63-12425 Picatinny Arsenal. Liquid Rocket Propulsion Lab., Dover, N.J.
A CLOSED-LOOP HEAT TRANSFER TEST APPARATUS
Jay R. Grossman Oct. 1962 19 p 8 refs
(Picatinny Arsenal Tech. Memo 1119)

The ability of a propellant to regeneratively cool is limited by the values of heat flux at the upper limit of nucleate boiling qul. A closed-loop test apparatus to determine the heat transfer characteristics of high-energy monopropellants has been designed and operated. Included are details of the flow circuit and calculations used to determine heat flux values. Verification of the system was accomplished in two ways: (1) comparing test data to a theoretical standard and (2) comparing consistency of similar data. Test results using white fuming nitric acid (WFNA) compare within 15 percent of theoretical predicted by the Sieder and Tate equation for turbulent flow through tubes, which is typical of forced convection nonboiling heat transfer measurements. Slopes and inception of nucleate boiling for two different tests under similar conditions were identical. These initial tests, using a high-energy monopropellant as the test fluid, successfully demonstrated that the upper limit of nucleate boiling can be attained. At burnout there were no detonations or explosions, which demonstrates the adequacy of the system relative to safety precautions. Author

N63-12496 Union Carbide Nuclear Co., Oak Ridge, Tenn.
SALT BATH HEAT TRANSFER RATES FOR URANIUM PLATE
R. B. Burditt Feb. 1, 1962 51 p 5 refs
(Contract W-7405-eng-26)
(Y-1410) OTS: $1.50

An experimental study was made of the heat-transfer conditions of a salt bath—salt liner system of the type used for annealing uranium sheet. This system utilizes a small inner bath (liner) set into a larger outer bath which is used as a heat sump. Film coefficients were derived for salt-to-uranium, salt-to-liner-to-salt, and uranium-to-air systems for thin sheet. Conditions existing for rolled sheet for 7- and 12-minute annealing cycles were studied. Film coefficients were then used in combination with thermal conductivity values to obtain mathematical solutions for the process of heating and cooling plates of finite thickness and area. Results were checked experimentally for plates ranging in thickness from 0.274 to 1 inch and in surface area from 6½ by 6½ to 18½ by 18½ inches. Newtonian form constants were worked out for approximating the results on thick plates. Author

N63-12597 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

EFFECT OF LARGE-AMPLITUDE OSCILLATIONS ON HEAT TRANSFER

Charles E. Feiler and Ernest B. Yeager Washington, GPO, 1962 26 p 26 refs
(NASA TR R-142) GPO: $0.40

The heat transfer from a heated flat plate to an airstream having large-amplitude flow oscillations was studied. The oscillation frequency was varied from 34 cps to 680 cps. The root-mean-square oscillation amplitude was as much as 65 percent of the mean flow rate. In the presence of oscillations, the heat-transfer coefficient was increased by as much as 65 percent when compared with the coefficient at the same mean flow rate in the absence of oscillations. High-speed schlieren movies of the thermal boundary layer revealed that flow reversal occurred near the plate surface at each frequency during a portion of the period of oscillation. The mean flow velocity ranged from about 30 to 100 feet per second. Author

N63-12666 Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa.

FLAME CONTACT STUDIES. I. APPARATUS AND METHOD FOR DETERMINATION OF HEAT TRANSFER THROUGH FABRIC DURING FLAME CONTACT

Alice M. Stoll and Lambert R. Monroe Dec. 26, 1962 19 p 5 refs
(NADC-MA-6215; Bur. of Med. and Surgery Rept. -28)

A series of studies of heat transfer through lightweight fabric of a new heat-resistant, non-flammable synthetic fiber in contact with fuel flames serves to illustrate a system for determination of such thermal behavior. In this paper the method and data are given for ascertaining the destruction temperature of the fabric, its resistance to heat transfer, and the insulation effect of air-spaces between two layers of the material. Author

N63-12754 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

A DETERMINATION OF THE TEMPERATURE FIELD AND THE HEAT LOSSES IN THE INSULATION BARRIER OF COMPRESSED-GAS TANKS

S. M. Rips Dec. 19, 1962 22 p 1 ref Transl. from Khim. Prom., no. 2, 1962 p 59-65
(FTD-TT-62-1459/1+2+4)

The heat flows (cold losses) in the insulation barrier of compressed-gas tanks are determined both during the cooling of the tank insulation (nonsteady state) as well as after the temperature field has been established. Examples are given of the calculations for liquid oxygen, nitrogen, and hydrogen. An analysis of the data shows that the maximum influx of heat to the tank is observed in the initial cooling stage. The intensity of the heat flow decreases in the course of time, as the steady state is approached, and becomes equal to the intensity of the influx from without. On the basis of the data given, it is possible to determine the absolute values of the compressed-gas losses for different types of insulation and their distribution over time. Also, the greater the density and specific heat of the insulation, the more the liquid expended in cooling it and the longer the duration of this process. B.J.C.

N63-12820 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

COLLECTION OF SCIENTIFIC PAPERS, HEAT POWER ENGINEERING (SELECTED ARTICLES)

L. I. Kudryashev and L. I. Zhemkov Jan. 9, 1963 39 p 13 refs
Transl. from Sb. Nauchn. Tr., Teplotekhnika (Kuybyshev), no. 8, 1959 p 3-29
(FTD-TT-62-1200/1+2+4)

CONTENTS:

1. GENERALIZATION OF THE THEORY OF REGULAR THERMAL REGIME FOR THE CASE OF VARIABLE COEFFICIENTS OF HEAT CONDUCTIVITY AND SPECIFIC HEAT L. I. Kudryashev and L. I. Zhemkov p 1-21 8 refs
2. REGULAR HEAT REGIME IN BODIES WITH INTERNAL SOURCES OF ENERGY AND VARIABLE THERMOPHYSICAL PROPERTIES L. I. Kudryashev and L. I. Zhemkov p 22-27 3 refs
3. GENERALIZATION OF G. M. KONDRAT'EV'S THEOREM FOR THE CASE OF VARIABLE COEFFICIENTS OF HEAT CONDUCTIVITY AND SPECIFIC HEAT AND THE USE OF THIS GENERALIZED THEOREM TO DETERMINE THERMOPHYSICAL PROPERTIES OF MATERIALS L. I. Kudryashev and L. I. Zhemkov p 28-36 2 refs

14 HUMAN BEHAVIOR

Includes: crew training and evaluation; piloting; psychological factors.

For simulators see: 10 Facilities.

For related information see: 16 Life Sciences.

N63-12463 Aerospace Medical Div. School of Aerospace Medicine, Brooks AFB, Tex.

HEARING OF AIR FORCE PILOTS: 1955 TO 1962

Lois L. Elliott Dec. 1962 10 p 9 refs
(SAM-TDR-62-127)

This report surveys the hearing levels of all Air Force pilots examined at the School of Aerospace Medicine from 1955 through mid-April 1962. Pilots are found to have generally superior hearing when compared by age groups with hearing levels of two comparison groups. Author

N63-12685 Advisory Group for Aeronautical Research and Development, Paris (France)

MAN AND RADAR DISPLAYS

C. H. Baker (Defence Research Medical Labs., Toronto, Canada) Oxford, Pergamon Press, 1962 201 p 370 refs
(AGARDograph-60)

The book, "Man and Radar Displays," should be of great value to writers of radar specifications, radar designers, radar instructors, and to those in authority over radar operators. The following material is presented: (1) radar scope brightness, (2) pip decay time and visibility threshold, (3) visibility as a function of pip dimensions, (4) ambient illumination, (5) some visual and perceptual factors, (6) searching for pips, (7) visual estimation of range and bearing, (8) aids to accuracy in reporting range and bearing, (9) plotting and transmission of radar display data, and (10) the operator as a monitor. I.v.L.

N63-12703 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INVESTIGATION OF THE VISUAL BOUNDARY FOR IMMEDIATE PERCEPTION OF VERTICAL RATE OF DESCENT

Lindsay J. Lina and Arthur Assadourian Washington, NASA, Feb. 1963 25 p 1 ref
(NASA TN D-1591) OTS: $0.75

Simple optical projection equipment was used to determine the threshold of visual ability to detect quickly rates of change of visual

angle. A brief analytical treatment shows the relationship of visual angular rate to closure speed or rate of vertical descent. Application of the data was made to the ranges of speed and distance that could, for example, be encountered under emergency conditions in a vertical landing from a straight-in lunar approach. The results indicate that a pilot has adequate visual ability to control a landing, even in this case of extreme closure velocity, if a reasonable braking thrust is available. Author

N63-12823 Applied Psychology Corp., Arlington, Va.
IMPLICATIONS OF MID-AIR VISUAL COLLISION AVOIDANCE RESEARCH FOR HIGHWAY SAFETY
Theodore H. Projector, Kenneth G. Cook, and Robert B. Sleight Jan. 1963 14 p 7 refs Presented at the 42nd Annual Meeting, Highway Research Board, Washington, D.C.
(Supported by Navy and FAA)

Data obtained in previous mid-air visual collision avoidance studies is applied to highway safety considerations. Two studies were found to be applicable: (1) the detectability of signal lights against backgrounds of other lights and (2) the ability to judge the distance of a light that did or did not present some coded information of its distance. M.P.G.

15 INSTRUMENTATION

Includes: design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; and sensors and transducers.

For related information see: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N63-12351 California Inst. of Tech. Seismological Lab., Pasadena
A SEISMOGRAPH FOR LUNAR EXPERIMENTS
F. E. Lehner, E. O. Witt, W. Miller, and R. D. Gurney Repr. from J. Geophys. Research, v. 67, no. 12, Nov. 1962 p 4779-4786 4 refs
(NASA Contract NASw-81)

Prompted by instrument requirements for the Ranger series of lunar landings, a seismometer capable of hard landings on the moon has been developed. Survival of 3000G impacts has been achieved. The instrument includes devices for automatic adjustment of the suspended mass position and for generation of pulses to verify the performance. The complete system of seismometer, Ranger telemetry transmitter, and earth-based receiver and recorder has resulted in a seismograph system having a maximum magnification of 1.7×10^6. Author

N63-12352 Georgia Inst. of Tech. Engineering Experiment Station, Atlanta
A SUBMILLIMETER INTERFERENCE SPECTROMETER
W. K. Rivers, Jr., and M. S. Spiel [1963] 25 p 6 refs Presented at the Millimeter and Submillimeter Conf., Orlando, Fla., 7-10 Jan. 1963
(NASA Grant NsG-258-62)
OTS: $2.60 ph, $0.95 mf

A spectrometer which uses the principle of interference modulation is being constructed for use at submillimeter and the shorter millimeter wavelengths. Broadband noise sources and detectors will be used to obtain spectra of solids and gases with unusually high resolution in this region. The problems encountered in the design of the instrument and the details of their solution are presented. The factors controlling the transmission efficiency of the system and the rejection of unwanted radiation are discussed. The resolution and upper frequency limit desired impose unique problems in data acquisition, recording, and processing. The detector output must be sampled at precise intervals of path delay over a considerable distance, so that conventional mechanical length standards are marginal. In addition, the number of data points eventually required for the designed resolution will exceed 20,000, so that unusual data recording and processing techniques must be employed. The approaches to economical solutions to these problems are discussed. Author

N63-12363 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham
A MEASURING INSTRUMENT FOR EXPLOSION VIBRATIONS (MESSGERÄT FÜR SPRENGERSCHÜTTERUNGEN)
H. Baule Dec. 1962 8 p Transl. from Nobel Hefte, 67-71, 1961, Germany
(TIL/T-5280)

An electrodynamic moving coil vibration meter was developed in which a mass carrying electrical coils vibrates in a magnetic field. The induced voltage is proportional to the speed of the vibrations. The electrical supply feeds a mirror galvanometer, and a light trace is recorded on photographic paper. The meters can be used in horizontal or vertical planes and are suitable for measuring ground frequencies up to about 100 c.p.s. Examples of use are given. Author

N63-12366 Massachusetts Inst. of Technology. Electronic Systems Lab., Cambridge
PRELIMINARY ANALYSIS OF FIVE POSSIBLE VIBRATORY OUTPUT ANGULAR MOTION SENSORS
Richard W. Bush June 1962 63 p 11 refs
(NASA Grant NsG-149-61)
(ESL-R-137) OTS: $6.60 ph, $2.09 mf

Five different schemes for detecting angular rates employing a high-Q mechanical sensing system in the output are analyzed. Sensitivities expressed in terms of output displacement amplitude per unit rate input are derived in addition to equivalent rate inputs due to thermal fluctuations in the device. If 10^{-12} centimeters is taken as the minimum detectable amplitude of vibrations, and the signal to noise ratio going into the output transducer (noise due to thermal fluctuations) has a minimum value of unity, three of the schemes analyzed should be able to detect 10^{-3} earth rates. This is the ultimate performance limit of the devices and does not consider practical limitations such as bearing noise, unwanted cross coupling, etc. Two different approaches are employed to reduce the effects of unwanted cross coupling that is characteristic of vibratory devices. One approach involves double modulation and the other an asymmetrical rotor. The asymmetrical rotor schemes appear approximately an order of magnitude better than the double modulation scheme but require that vibratory forces be transmitted through bearings to the high-Q sensor. Little is presently known about the noise and attenuation which will be encountered here so the conclusion is that further work is necessary on both approaches to uncover the practical performance limitations. Author

N63-12409 Naval Ordnance Lab., Corona, Calif.
PROPERTIES OF PHOTODETECTORS. PHOTODETECTOR SERIES, 54TH, REPORT
J. D. Merriam, A. B. Naugle, and W. L. Eisenman Dec. 1, 1962 27 p
(NOLC-575)

This report gives the results of tests on 10 photodetectors. It includes data sheets on copper oxide and indium antimonide samples from the Philco Corp., and on thermistor bolometers from the Servo Corp. of America. Author

N63-12429 Naval Ordnance Lab., Corona, Calif.
EFFECTS OF AGING ON LEAD SELENIDE DETECTORS. PHOTODETECTORS SERIES, 55TH REPORT
J. D. Merriam Jan. 15, 1963 17 p 4 refs
(NOLC-576)

Results are reported of a study made on ten cooled PbSe photoconductive detectors that were stored at an ambient temperature of 22° C ± 2° for periods of from six to eight months. Six of the detectors were evaporated cells produced by the Eastman Kodak Company and operated at dry ice temperatures; four were chemically deposited cells produced by the Santa Barbara Research Center and operated at liquid nitrogen temperatures. A small change in dark resistance appeared to be the only noticeable effect of aging.
Author

N63-12448 Comitato Nazionale per l'Energia Nucleare. Lab. di Elettronica, Rome (Italy)
UN CONTATORE ELETTRONICO PER DOSI DI RADIAZIONE [AN ELECTRONIC METER FOR RADIATION DOSES]
R. Cervellati, R. Marconero, and C. Pedicino CNEN Div. Affari Intern. e Studi Econ., Uffic. Pubbl., Sept. 1962 25 p 1 ref In Italian; English summary
(RT/EL(62)11)

An electronic apparatus is described for the measurement of the electric charge carried by current in the range 10^{-6} A ÷ 10^{-12} A, particularly useful for measurements of exposure dose to ionizing radiation.
Author

N63-12455 Hanford Atomic Products Operation, Richland, Wash.
MEASUREMENT OF CYLINDRICAL SHAPES
K. R. Merckx and R. G. Wheeler Aug. 27, 1962 24 p 1 ref
(Contract AT(45-1)-1350)
(HW-71521, REV) OTS: $0.50

The measurement of a cylinder or tube and the significance of these measurements as related to fuel element fabrication and/or irradiation performance is described. Instead of the previous use of isolated measurements, continuous records of radial displacements and tube wall thickness are used to evaluate mean diameters, warp, ovality, mean wall thickness, and eccentricity. Description of the measuring and data recording equipment and the method of harmonic analysis with its interpretation and computer program are given. An evaluation is made of the experience obtained on fuel tubes measured before irradiation. The data developed from this preirradiation study and the matching postirradiation study are an integral part of fuel element testing and metallurgical evaluation program.
Author

N63-12456 Hanford Atomic Products Operation, Richland, Wash.
A DEVICE FOR RECORDING FUEL ELEMENT DIMENSIONS ON PUNCHED PAPER TAPE
G. E. Driver Dec. 1962 36 p
(Contract AT(45-1)-1350)
(HW-75746) OTS: $1.00

This paper describes a system for translating the position of a strip-chart recorder potentiometer shaft into decimal digital form. With a paper tape punch, measurements of fuel element dimensions are thereby recorded in a medium convenient for computer analysis. Speed and reliability of data handling are greatly increased compared with formerly used clerical methods.
Author

N63-12475 Naval Radiological Defense Lab., San Francisco, Calif.
A METHOD OF COMPENSATING FOR TEMPERATURE-DEPENDENCE OF A REMOTE AREA GAMMA MONITORING SYSTEM
P. A. Covey Nov. 27, 1962 10 p 2 refs
(USNRDL-TR-604)

A remote area gamma radiation monitoring system known as RAMS II, was found to be so temperature-dependent that diurnal variations produced intolerably large output variations. Addition of a thermistor-resistor combination in the cathode circuit of the electrometer tube successfully compensated for temperature effects. The response of the modified system is constant within ±10% between 30° F and 80° F, as opposed to an original factor-of-3 variation over this temperature range.
Author

N63-12481 Naval Radiological Defense Lab., San Francisco, Calif.
PHOTOMICROGRAPHIC TECHNIQUE FOR MEASURING GRAIN DENSITIES OF HIGHLY IONIZED PARTICLE TRACKS IN NUCLEAR EMULSIONS
E. V. Benton Oct. 26, 1962 17 p 8 refs
(USNRDL-TR-591)

A technique for rapid and accurate measurement of gap lengths of nearly saturated particle tracks in nuclear emulsions is reported. The method consists of obtaining photomicrographs of particle tracks with a superimposed image of a calibrated eyepiece-micrometer disc. The gap lengths are measured to an accuracy of ¼ micron.
Author

N63-12568 Comitato Nazionale per l'Energia Nucleare. Lab. Nazionali, Frascati (Italy)
MESURE DU RENDEMENT DE CONVERSION NEGATON-POSITON [OUTPUT MEASUREMENT OF NEGATON-POSITON CONVERSION]
J. Miller, C. Schuhl, G. Tamas (Centre d'Etudes Nucleaires de Saclay), and M. Bernardini Aug. 2, 1962 21 p 10 refs In French
(Its Nota Interna 154; LNF-62-66)

Results of negatron-positron conversion are presented. Measurements have been obtained for energies of primary negatrons $E^- =$ 9.3, 11.5, 15.0, 19.5, 24.5, and 30.5 mev; platinum thicknesses of 0.5, 1, 2, 3, 4, and 6 mm; and the energies E^+ of positions varying by jumps of 1.6 mev. In the case of the measurement of $E^- = 9.3$ mev, the energy intervals are lower. Directly measured currents, $i(E^-, E^+)$, are then divided by $\Delta E^+ = R_0 E^+$, by the intensity of the primary negatrons, and by the amplification of the xenon ionization chamber. Thus $d\rho \frac{(E^-, E^+)}{dE}$ is derived producing the conversion $e^- e^+$ for energy bands of the order of 1 mev and in the solid angle $\Omega_0 = 5.4.10^{-3}$ steradian: $d\rho \frac{(E^-, E^+)}{dE} = \frac{i+}{R_0 E}$ where R is the value of the calculated resolution and Ω_0 is the value of the solid angle determined experimentally. The derivation of $d\rho \frac{(E^-, E^+)}{dE}$ is a general optimum for the expansion of a conversion of the order of one length of radiation. The network curves presented permit the choice of the optimum expansion as a function of advanced fixed exigencies. It can be concluded that the results represent a low limit of derivation for the conversion (e^-, e^+).
I.v.L.

N63-12634 France. Office National d'Etudes et de Recherches Aéronautiques, Chatillon-sous-Bagneux
MESURE DES PRESSIONS RAPIDEMENT VARIABLES ET EN PARTICULIER DANS DES ÉCOULEMENTS A HAUTE TEMPÉRATURE (MEASUREMENT OF QUICKLY VARIABLE PRESSURES WITH SPECIAL APPLICATION TO HIGH TEMPERATURE FLOWS)
Jean Girvès Nov. 1962 11 p 4 refs In French; English summary
(ONERA-91)

In this paper are described O.N.E.R.A.-designed pressure pickups which have a broad bandwidth or which are in direct contact with media up to 3700° K. The various types are studied in detail as well as the detecting electronic systems. Besides the specifically aeronautical applications for which they have been developed, these pickups have wide applications in various domains because of their capability to give simultaneously the mean pressure and the fast

variations of the instantaneous pressure. The electronic detector which works in conjunction with them allows telemetering over long distances; the practical use of these pickups is particularly simple with the transistorized versions. B.J.C.

N63-12700 Polytechnic Inst. of Brooklyn. Microwave Research Inst., N.Y.

MEASUREMENT OF NEURON ACTIVITY BY PARAMAGNETIC RESONANCE

Michael A. Kelly Nov. 9, 1962 23 p 9 refs
(Grant AF-AFOSR-62-295)
(PIBMRI-1071-62)

A theory is proposed for measuring neuron activity at any desired location in a living animal by a technique that requires no physical contact between the subject and the detector. The theory postulates that free radicals are produced in the formation of neuron action potentials, and that the concentration of these free radicals can be measured by magnetic resonance techniques. A device to test these postulates has been built, but does not yet possess the sensitivity needed to give the theory a meaningful test. The design and construction of this device is described. Author

N63-12727 Oak Ridge National Lab., Tenn.

INSTRUMENTATION AND CONTROLS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 1, 1962

C. J. Borkowski and C. S. Harrill Feb. 6, 1963 102 p refs
(Contract W-7405-eng-26)
(ORNL-3378)

The Instrumentation and Controls Division reports on the following areas: electronic systems and components; semiconductor research; radiation monitoring systems; radiation detection instruments and components; data handling and computation; process instrumentation and control systems; process instrumentation development; reactor instrumentation and controls; and support for the high-voltage accelerator program. R.C.M.

N63-12748 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NEW METHOD OF MEASURING ELECTRICAL CONDUCTIVITY WITH A MAGNETIC PROBE

K. Thom and J. Norwood, Jr. Repr. from Phys. Fluids, v. 5, no. 11, Nov. 1962 p 1485

A new method is described for measuring the electrical conductivity of a moving conductor with a magnetic probe. A probe technique, based on this method, is expected to be developed for measuring the conductivity of transient plasma bursts as ejected from pulsed-plasma guns. When a conducting body passes through a magnetic field at rest, the lines of force are displaced until an equilibrium of the induction drag forces and the magnetic stresses of the distorted field is established. A magnetic-probe coil placed in the area of the magnetic field monitors the rate of change of the magnetic flux density $\delta B/\delta t$. When the lines of force approach the state of equilibrium, $\delta B/\delta t$ approaches zero. By measuring the decay time, τ, of $\delta B/\delta t$ as the decay time of the voltage signal displayed on an oscilloscope, the conductivity of the passing conductor can be determined. B.J.C.

N63-12751 Hoffman Electronics Corp. Hoffman Semiconductor Div., El Monte, Calif.

DESIGN STUDY OF SOLAR ENERGY MEASUREMENT TECHNIQUES Interim Report [Mar. 1961-Jan. 15, 1962]

Bernd Ross and D. B. Bickler Wright-Patterson AFB, Ohio, Flight Accessories Lab., June 1962 70 p 9 refs
(Contract AF 33(616)-7946)
(ASD-TN-61-156)

This study is concerned with the fabrication of a portable solar cell tester which will present solar cell power output data for space conditions. The initial phase of the work deals with the measurement of solar cell performance and characteristics of available light sources in order to establish the basic design parameters for the tester. The operational design of the tester is described. Solar cell performance data and characteristic tolerances are given. The design of a new primary reference solar cell is described, and a calibration procedure resulting in the absolute spectral response is set forth. Author

N63-12761 Federal Aviation Agency. Systems Research and Development Service, Atlantic City, N.J.

EVALUATION OF THE COFFING THREE DIMENSIONAL GYROSCOPIC HORIZON DISPLAY Final Report

Roger M. Hardwicke and Paul M. Rich Nov. 1962 44 p 5 refs

The Coffing three-dimensional horizon instrument was evaluated to ascertain the value of this instrument to the VFR General Aviation Pilot. Test results indicated that noninstrument-rated pilots made fewer control errors using the Coffing instrument, while instrument-rated pilots interpreted the conventional horizon more rapidly. It was also found that, although the Coffing instrument provides a satisfactory coarse indication of aircraft attitude, it does not provide precise flight information. It was concluded that the Coffing instrument is of value to the VFR General Aviation Pilot when accidentally entering instrument flight conditions, and it is recommended that this instrument be used by this type of pilot. Author

N63-12776 Massachusetts Inst. of Tech. Instrumentation Lab., Cambridge

A MULTIRANGE PRECISION TORQUE MEASURING DEVICE

P. J. Gilinson, Jr., C. R. Dauwalter, and J. A. Scoppettuolo July 1962 87 p 8 refs
(NASA Contract NAS9-153)
(R-367) OTS: $8.10 ph, $2.81 mf

A precision torque-measuring system for torques ranging from 0.010 to 1000 dyne-centimeters is described. The unknown torque is measured by a feedback system which automatically develops a balancing torque by means of an electromagnetic torque generator. The inphase product of the primary excitation and the secondary feedback current into the torque generator to develop this balancing torque is the measure of the unknown torque. A dynamometer-type wattmeter or Hall Effect current product device is used to measure the inphase current product. By the proper use of a decade attenuator in the torque generator feedback circuit and by the adaptive control of the system elastance, the wide range of torques can be measured to a precision of about 0.1 percent of full scale. Author

N63-12817 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

A PULSED ULTRASONIC THERMOANEMOMETER

N. P. Fateyev Jan. 15, 1963 3 p Transl. from Russian Patent 134920, Nov. 21, 1959
(FTD-TT-62-118/1+2+4)

A pulsed ultrasonic thermoanemometer is described which would measure the velocity of an airstream without errors due to temperature or humidity, and also measure the temperature of the stream without being influenced by the velocity. The velocity is measured from the difference between the frequencies of pulse-modulated ultrasonic oscillations propagating in opposed directions in a closed dynamic system. A device is added which sums the frequency of pulse repetition in each of the two receivers, thereby eliminating stream effects from the temperature measurements. M.P.G.

16 LIFE SCIENCES

Includes: biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness.

For related information see: 14 Human Behavior; and 28 Space Radiation.

N63-12356 Northrop Space Labs., Hawthorne, Calif.

BIOLOGICAL AND PHYSIOLOGICAL STUDIES OF PEROGNATHUS (POCKET MICE) Third Quarterly Status Report, 1 September-30 November 1962

R. G. Lindberg and D. F. Mitchell [1962] 10 p 8 refs
(NASA Contract NASr-91)
(NSL-62-125-2) OTS: $1.10 ph, $0.80 mf

Maintenance metabolic rates were measured for six species of pocket mice (*Perognathus flavus, longimembris, amplus, intermedius, formosus,* and *baileyi*), ranging in this order from average body weights of 7.5 to 31.0 grams. Metabolism was measured at 5°, 15°, 25°, 30°, and 35° C. Results indicated that (1) these six species show a "family relationship" in that as body weight is less, metabolic rate per gram of body weight is greater, conductance of heat is greater, and critical temperature is higher; (2) *Perognathus longimembris* diverges somewhat from this relationship in that its "minimum" maintenance metabolic rate is higher than expected for its size, conductance is less, and critical temperature is consequently higher than expected; this indicates that *Perognathus longimembris* has a more effective skin and fur insulation than generally exists for an animal of its size; (3) maintenance metabolic rate per gram of body weight sharply increases at weights below ten grams; the curve of data suggests a theoretical lower limit to body weight in this genus in the range of 2.5 to 3.5 grams. I.v.L.

N63-12378 Columbia U. Electronics Research Labs., New York, N.Y.

METHODS FOR DETERMINING BLOOD FLOW THROUGH INTACT VESSELS OF EXPERIMENTAL ANIMALS UNDER CONDITIONS OF GRAVITATIONAL STRESS AND IN EXTRA-TERRESTRIAL SPACE CAPSULES Status Report, May 1, 1961-July 30, 1962

R. F. Shaw Aug. 1, 1962 226 p 62 refs
(NASA Grant NsG 112-61)
(P-2/168; CU-2-62-NASA-112-ERL) OTS: $15.00 ph, $6.98 mf

Progress is reported in the four areas pursued: (a) analysis of fundamental phenomena operative in the measurement of blood flow by electromagnetic induction, (b) design of special circuitry and development of probe fabrication techniques, (c) perfection of techniques of chronic implantation, and (d) continued study of principles of circulatory regulation and the relation of organ blood flow to levels of physiologic activity. An analytic and experimental investigation was completed of the effects of radial asymmetry on the indications of electromagnetic flowmeters. Investigation further elucidated sources of spurious signals. A flowmeter system using sinusoidal drive and a flowmeter system using alternating direct current have been completed with specially designed components. A transistorized, subminiaturized flight-model flowmeter was designed and built. Evolution of flowmeter probe design and fabrication techniques continues with lighter, smaller, and more reliable probes for specific anatomic sites. Flowmeter probes have been implanted on aorta, pulmonary, carotid, femoral, and hapatic vessels. Primates were prepared for continuous measurement of cardiorespiratory function during flight. Investigations of autoregulation in the control of the coronary circulation were completed and illustrated that measurement of coronary blood flow sensitivity reflects the moment to moment level of cardiac performance. Regulatory mechanisms of liver blood flow were studied. A preliminary electrical analog for the pulmonary circulation was derived and a protocol developed for its refinement and application as a computer in hemodynamic studies. Author

N63-12391 Joint Publications Research Service, Washington, D.C.

TRANSLATIONS FROM MEDITSINSKAYA RADIOLOGIYA (MEDICAL RADIOLOGY) [MOSCOW] VOL. 7, NO. 11, 1962

Jan. 31, 1963 58 p 74 refs Transl. of 8 articles from Med. Rad. (Moscow), v. 7, no. 11, 1962
(JPRS-17402) OTS: $1.50

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2. FIRST AID IN RADIOACTIVE IODINE POISONING V. P. Borisov p 7-14 4 refs (See N63-12393 05-16)
3. CHANGES IN PERIPHERAL BLOOD DURING RADIATION THERAPY Ye. V. Karibskaya and T. E. Matetskaya p 15-23 (See N63-12394 05-16)
4. EARLY CHANGES IN THE SKIN CHRONAXY AND VISUAL ANALYSORS A. F. Yefimova p 24-31 18 refs (See N63-12395 05-16)
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6. TREATMENT OF RADIATION SICKNESS BY HOMOTRANSPLANTATION OF FRESH AND PRESERVED SPLEEN V. A. Revis p 36-47 40 refs (See N63-12397 05-16)
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N63-12392 Joint Publications Research Service, Washington, D.C.

ORGANIZATION OF WORK AND NORMS FOR THE WORK-LOAD OF PERSONNEL ENGAGED IN THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE THYROID GLAND BY RADIOACTIVE IODINE

V. K. Frenkel' *In its* Translations from Meditsinskaya Radiologiya (Medical Radiology) [Moscow] v. 7, no. 11, 1962 Jan. 31, 1963 p 1-6 6 refs (See N63-12391 05-16) OTS: $1.50

Organization of work and norms for personnel engaged in the diagnosis and treatment of diseases of the thyroid gland by radioactive iodine was investigated. Results indicated that: (1) The use of scintillation counters with high recording efficiency of gamma quanta makes it possible to reduce the indicator dose and decrease the count time without the loss of reliability. (2) The personnel's load in diagnosing is determined only by the time necessary for recording a given number of impulses. (3) The development of unified organizational methods of work and personnel norms in radiological sections can be made possible by developing nets of typical isotope laboratories, applying uniform protective equipment and remote instrumentation, and unifying the methodology of the diagnostic and therapeutic utilization of iodine 131. I.v.L.

N63-12393 Joint Publications Research Service, Washington, D.C.

FIRST AID IN RADIOACTIVE IODINE POISONING

V. P. Borisov *In its* Translations from Meditsinskaya Radiologiya (Medical Radiology) [Moscow] v. 7, no. 11, 1962 Jan. 31, 1963 p 7-14 4 refs (See N63-12391 05-16) OTS: $1.50

Therapeutic and prophylactic means for treating radioactive iodine poisoning were investigated. Test animals were rats and dogs

which had been administered iodine 131. Results indicated that thyrostatic substances (mercazolyl, 6-methylthiouracil, potassium and ammonium thiocyanates, sodium perchlorate, thiourea, resorcin), calcium iodobehenate, potassium and silver iodides, silver bromide, sulfodimezine, and radioprotective substances (mercamine, cystamine) demonstrate a high degree of efficiency as a first-aid measure in iodine 131 poisoning by sharply reducing the deposition of this isotope in the thyroid gland and accelerating its elimination from the organism. I.v.L.

N63-12394 Joint Publications Research Service, Washington, D.C.
CHANGES IN PERIPHERAL BLOOD DURING RADIATION THERAPY
Ye. V. Karibskaya and T. E. Matelskaya *In its* Translations from Meditsinskaya Radiologiya (Medical Radiology) [Moscow] v. 7, no. 11, 1962 Jan. 31, 1963 p 15-23 (See N63-12391 05-16)
OTS: $1.50

Changes in the peripheral blood of patients undergoing radiation therapy for various diseases were investigated. The blood of persons not undergoing radiation was examined for comparative purposes. The clinical picture stressed was the quantitative correlation between different cellular groups and the qualitative changes in the nuclei and protoplasm in patients during radiation therapy. The amount of hemoglobin, the number of erythrocytes, the erythrocyte sedimentation reaction, and the total number of leucocytes were examined, and a hemogram was qualitatively evaluated. Results indicated that: (1) The peripheral blood picture definitely reflects the patient's general condition and the organism's reaction to irradiation. (2) The character of peripheral blood changes in irradiated patients depends on the dose, size of the radiation field, method of irradiation, and the organism's individual sensitivity. (3) Changes in the peripheral blood picture, which are connected with the gravity of illness, are observed near the terminal phase of the process. (4) The peripheral blood picture, in combination with other clinical data, can be of prognostic value. (5) Rotational irradiation is the safest method of radiating peripheral blood. I.v.L.

N63-12395 Joint Publications Research Service, Washington, D.C.
EARLY CHANGES IN THE SKIN CHRONAXY AND VISUAL ANALYSORS
A. S. Yefimova *In its* Translations from Meditsinskaya Radiologiya (Medical Radiology) [Moscow] v. 7, no. 11, 1962 Jan. 31, 1963 p 24-31 18 refs (See N63-12391 05-16)
OTS: $1.50

The correlation between changes in receptors subjected and not subjected to irradiation and which were related and unrelated functionally to the irradiated organs was investigated. The investigation was carried out during a clinical physiological study of patients with cancer of the uteral cervix who underwent X-ray therapy. The cutaneous receptors and visual analyzer were examined in 24 patients prior to irradiation and then 30 minutes after irradiating the parametritic region (300 r or both fields consecutively). The state of the receptors was examined by determining the sensitivity threshold to a constant electric current and by measuring the chronaxy with the aid of an ISE-01 impulse electronic stimulator. Results indicated that: (1) there is a change in the functional state of receptors in organisms undergoing ionizing radiation; (2) changes in the sensitivity threshold were noticed only at four points, which were not directly irradiated, but which were reflexively related to nonirradiated liver, nonirradiated lungs, and irradiated urogenital organs; (3) chronaxy, which is an index of lability and reflects both the properties of a nerve and the state of the central nervous system, is a more sensitive indicator of ionization radiation's effect on the functional condition of the nervous system; (4) changes in the functional condition of receptors were observed both in the regions of irradiation and in remote points reflexively unrelated to irradiated organs; however, the irradiated sections reflected greater changes. I.v.L.

N63-12396 Joint Publications Research Service, Washington, D.C.
LUMINESCENT-MICROSCOPIC EVALUATION OF THE BLOOD AND BONE MARROW DURING X-RAY IRRADIATION
V. A. Kolpakov *In its* Translations from Meditsinskaya Radiologiya (Medical Radiology) [Moscow] v. 7, no. 11, 1962 Jan. 31, 1963 p 32-35 6 refs (See N63-12391 05-16)
OTS: $1.50

The effect of general external X-ray irradiation on the luminescent pattern of the blood and bone marrow of white rats was investigated. Special emphasis was placed on studying the influence of factors such as pH medium, time of dyeing, and mechanical compression of the pressure, and the influence of laboratory conditions (pressure, temperature, etc.). A working solution of orange acridine fluorochrome in concentrations of 1:500 to 1:10,000 was prepared in buffered isotonic mixtures immediately before examinations. The study was conducted, with the aid of an MBR-1 microscope, in the blue-violet region of the spectrum according to the method of crossed filters. The principal features of the methodology employed included the use of a dark-field condenser, an auxiliary filter which eliminated the basic ZhS-17 type fluorescence, and a specially mounted illuminator with a K-22 cine-lamp (30 V, 400 W) which allowed the use of a strong lens for magnifications of 600 to 800 times. Results indicated that: (1) a pH 7 or pH 8 is optimal for fluorochroming of blood and bone marrow elements with acridine orange; (2) the luminescent color change of blood and bone marrow in irradiated animals upon dyeing with acridine orange cannot be a reliable criterion for evaluating the gravity of radiation sickness; (3) a proper evaluation of the degree of injury to cellular elements must include a consideration of the cellular structural changes; and (4) because of the high degree of sensitivity of the luminescent method to changes in the laboratory conditions, it is essential to carefully standardize them in order to obtain reliable and uniform results. I.v.L.

N63-12397 Joint Publications Research Service, Washington, D.C.
TREATMENT OF RADIATION SICKNESS BY HOMOTRANSPLANTATION OF FRESH AND PRESERVED SPLEEN
V. A. Revis *In its* Translations from Meditsinskaya Radiologiya (Medical Radiology) [Moscow] v. 7, no. 11, 1962 Jan. 31, 1963 p 36-47 40 refs (See N63-12391 05-16) OTS: $1.50

Treatment of radiation sickness by homotransplantation of fresh and preserved spleen was investigated. Results indicated that: (1) Transplantation of fresh spleen has a definite therapeutic effect in acute radiation sickness in rabbits irradiated at a dose of 1,100 r. This effect is manifest by an increase in animal survival and a less severe clinical course of radiation sickness. (2) Preservation of spleen by daily freezing at -75° C in glycerin media and preservative Ts OLIPK- 7 ensures good retention of spleen tissue structure up to 45 days. (3) Preserved spleen retains its protective biological properties against radiation sickness. Transferred 20-day and 45-day preserved spleen significantly increases the survival of irradiated animals and facilitates a less severe course of radiation sickness. I.v.L.

N63-12398 Joint Publications Research Service, Washington, D.C.
EXPERIMENTAL EFFECT OF SEVERAL PHARMACOPEIAL PREPARATIONS ON RADIATION SICKNESS
A. V. Shubina *In its* Translations from Meditsinskaya Radiologiya (Medical Radiology) [Moscow] v. 7, no. 11, 1962 Jan. 31, 1963 p 48-50 (See N63-12391 05-16) OTS: $1.50

The effect of pharmacopeial preparations of two plant substances (*Aralia mandshurica* and plowed restharrow) and leucogen on radiation sickness in white rats was investigated. Results indicated that: (1) administrations of Aralia and restharrow caused a worsening of radiation sickness, (2) the combinations of leucogen and Aralia and leucogen and restharrow effected therapeutic action. I.v.L.

N63-12399 Joint Publications Research Service, Washington, D.C.
SCIENTIFIC CONFERENCE ON RECOVERY FROM RADIATION INJURIES

O. V. Popov *In its* Translations from Meditsinskaya Radiologiya (Medical Radiology) [Moscow] v. 7, no. 11, 1962 Jan. 31, 1963 p 51-55 (See N63-12391 05-16) OTS: $1.50

Reports presented at the scientific conference on recovery from radiation injuries were devoted, for the most part, to explaining the mechanisms of recovery in radiation injuries at various levels, from molecules and cells to the various tissues and systems of the organism. I.v.L.

N63-12418 Naval Research Lab., Washington, D.C.

ATMOSPHERIC CONTAMINATION IN THE SPACE CABIN

R. A. Saunders *In its* Report of NRL Progress Jan. 1963 p 7-11 7 refs (See N63-12416 06-01) OTS: $1.25

Organic contaminants dispersed in the atmospheres of Mercury spacecraft are adsorbed by activated charcoal in the environmental control system. The contaminants are later recovered from the charcoal in the form of a complex mixture by a process of vacuum desorption. The small volume of the space cabin and the low concentration of the various contaminants result in the recovery of very small quantities of contaminant mixture. The identification of the components in this mixture and the determination of their concentration in the original atmosphere require the use of microtechniques. The contaminant mixture is separated into its components by means of an analytical gas chromatograph. The individual components are recovered from the effluent stream of the chromatograph with a novel fraction collecting system and their identity established by means of infrared and mass spectral techniques. A summary is given of 27 organic contaminants recovered from several spacecraft atmospheres. Author

N63-12433 Aerospace Medical Div. Aeromedical Research Lab. 6571st), Holloman AFB, N. Mex.

DETERMINATION OF EQUIVALENT NATURAL FREQUENCY INDICATED BY ACCELEROMETERS MOUNTED OVER THE STERNUM DURING HUMAN IMPACT IN THE G_x DIRECTION [Interim Report]

Richard F. Chandler Dec. 1962 12 p 7 refs
(ARL-TDR-62-29)

Analysis of 29 human impact tests in the G_x position on the Daisy Decelerator indicated that the natural frequency of the response measured by sternum accelerometers varies inversely as the duration of the onset of the input deceleration. The value of the product of response frequency (cps) and onset duration (sec) is approximately 0.5. Author

N63-12461 Aerospace Medical Div. School of Aerospace Medicine, Brooks AFB, Tex.

VENTILATION OF THE NORMAL AND BLOCKED MIDDLE EAR A Review of Mechanisms

Richard A. Davison Nov. 1962 19 p 28 refs
(*Its* Aeromedical Review 7-62)

The middle ear can be ventilated by various methods. The Valsalva maneuver, currently recommended by the Air Force as a method for inflating the middle ear, is described and its shortcomings for use in modern aviation are pointed out. Although the Valsalva maneuver serves adequately to ventilate the blocked ear in most cases, its predisposition to cause syncope and its relative inefficiency warrant reevaluation of alternate methods. It is proposed that the rather lengthy name of "nasopharyngeal positive pressure maneuver" be replaced by the shorter term, "Frenzel maneuver," placing it in its rightful category beside the Valsalva and Toynbee maneuvers. If further studies bear out its greater efficiency, it might be advantageous to the Air Force to adopt the Frenzel maneuver as a recommended means for voluntary middle ear inflation. The reason given for this proposal is threefold: (1) the eustachian tube opens at a lower pressure with the Frenzel maneuver than with the Valsalva; (2) equal or higher maximum pressures can be developed with the Frenzel maneuver, giving an additional safety factor; and (3) accomplishment of the Frenzel maneuver is entirely independent of intrathoracic pressure and phase of respiration. Thus, there is no tendency for production of syncope during performance of the Frenzel maneuver. In addition, end-expiratory performance of the Frenzel maneuver may facilitate the equilibration of gases within the middle ear with the ambient atmosphere. This is of considerable advantage in the prevention of oxygen-absorption barotitis. The Frenzel maneuver may also be of benefit in the treatment of chronic serous otitis media. The relative advantages and disadvantages of the Toynbee maneuver, politzerization, and eustachian tube catheterization are also discussed. Author

N63-12462 Aerospace Medical Div. School of Aerospace Medicine, Brooks AFB, Tex.

THE EFFECT OF DECREASED BAROMETRIC PRESSURE ON OXYGEN CONSUMPTION

Louis F. Johnson, Jr., J. Ryan Neville, and Richard W. Bancroft Sept. 1962 10 p 7 refs
(SAM-TDR-62-94)

There have been conflicting reports in the literature concerning the effect of decreased barometric pressure on oxygen consumption, some reports citing a decrease in consumption, and others citing no change in consumption. The resting oxygen consumption of 8 healthy men was measured at ground level at 18,000 feet pressure altitude, and at 30,000 feet pressure altitude. There was no change in oxygen consumption with change in pressure altitude. The findings were discussed from three aspects: (1) the work of breathing at low barometric pressures; (2) the methodology for measuring oxygen consumption; and (3) a possible decreased nitrogen effect. Author

N63-12466 Army Chemical Center. Army Chemical Research and Development Labs., Md.

SHORT-EXPOSURE INHALATION TOXICITY OF PENTABORANE IN DOGS [Final] Technical Documentary Report [Oct. 1961-June 1962]

Francis W. Weir, Van M. Seabaugh, Millard M. Mershon, David G. Burke, and Maurice H. Weeks Wright-Patterson AFB, Ohio, Biomedical Lab., Dec. 1962 18 p 7 refs
(Contract MIPR(33-616)61-35)
(AMRL-TDR-62-145) OTS: $0.50

Studies are reported on the responses of dogs to pentaborane vapor. Single exposures of dogs for 5-, 15-, and 60-minute periods to 26, 12, and 3 ppm, respectively, produced minimal or no signs of toxicity. Daily repeated exposures at approximately these levels caused convulsions, apprehensiveness, scleral injection, and miosis after the second exposure. Dogs exposed daily for 5 days to 9.3, 5.0, and 1.4 ppm for 5-, 15-, and 60-minute periods showed irritability, scleral injection, miosis, and increased response time in a conditioned avoidance response test. Increases in urinary boron excretion were seen after all exposures. A greater increase in excretion was seen at the higher levels of pentaborane exposure than at the lower levels. Author

N63-12482 National Research and Development Corp., Atlanta, Ga.

NUTRITIONAL ASPECTS OF SPACE FLIGHT

Carsbie C. Adams [1962] 11 p 7 refs

Since manned space operations of the future will be quite varied in nature and scope, the food logistics will be quite different also. The basic categories of flight are excursions of short duration, a few hours to a few days; moderate duration, several days to several months; long duration, several months to a few years. For flights of short duration, there is no absolute requirement for a balanced diet. However, the foods selected should provide a maximum of energy with a minimum time required for eating, and should be in a form compatible with consumption under weightless conditions. For excursions of moderate flight, dehydrated but palatable foods will be

required. The total daily metabolism of an astronaut will require no more than 2400 calories. Since the percentage of fat, protein, and carbohydrate in the synthetic food will alter the oxygen and water requirements, a food concentrate containing about 52 percent carbohydrates, 32 percent fat, and 16 percent protein is recommended. Approximately five pounds of water will be required per day per man to hydrate food and also to serve as beverage. For excursions of long duration, a regenerative, recycling system should be used to produce within the sealed ecology all necessities for life and to reuse all waste material. Biological recycling systems still need much development for effective use. The answer may lie in various methods to reduce the space crew's total metabolic requirements, such as reduction in the amount of thyroid secretion or in the metabolic requirements of the cells of the body. B.J.C.

N63-12632 California U., Berkeley. Space Sciences Lab.

BIOLOGICAL SYSTEMS IN INTERPLANETARY ENVIRONMENT Final Status Report

John V. Slater, ed., et al Sept. 1, 1962 87 p 50 refs

(NASA Grants NTF-74 and NsG-94-60)

(*Its* Ser. 3, Issue 25) OTS: $8.10 ph, $2.81 mf

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N63-12660 Defence Standards Labs., Maribyrnong (Australia)

FUNGAL GROWTHS IN AVIATION FUEL SYSTEMS. PART 2. TEST METHODS

G. F. Hazzard and E. C. Kuster Dec. 1962 17 p

(Rept. 252)

Fungus growths in aviation fuel systems are investigated by three different methods. One method describes a procedure for the determination of fungus growths or spores in petroleum fractions or water which has been associated with these systems in process systems. A known quantity of the sample is passed through a sterile membrane of 0.45 micron pore size, and the membrane is placed on a nitrient medium for incubation. The number of such microbiological growths at the end of 4 days incubation is reported as the "fungus count". The second method of sampling describes a procedure by which samples may be obtained from any point in a fuel system, at which the static head exceeds 5 feet. A bomb sampler fitted with a sterile field monitor is attached to the system. A suitable amount of sample is passed through the monitor from which the membrane is transferred to the surface of a nutrient medium for the cultivation of microbiological material. The third method provides a rapid determination of whether micro-organisms can penetrate thin films of organic coating materials either in the form of a continuous self-supporting film, or as a continuous coating applied to a nylon fabric substrate. A membrane of the coating material, sealed across the mouth of a tube, is immersed at the interface of kerosene/Bushnell-Haas medium in a test jar. The upper surface is inoculated with a suspension of viable fungus spores or hyphae, and the assembly is placed in an incubator at 90° F. Visual observation of the underside is made at intervals to detect the first appearance of fungus growth through the film. I.v.L.

N63-12716 Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa.

THE EFFECTS OF APPLIED OCULAR PRESSURE AND OF POSITIVE ACCELERATION ON PHOTIC DRIVING IN MAN Report No. 16

T. D. Duane, S. Donald Weeks (Jefferson Med. Coll.), David H. Lewis (Gothenburg U.), and James F. Toole (Bowman Gray Med. School) Dec. 28, 1962 13 p 10 refs

(NADC-MA-6214)

Several subjects who demonstrated the phenomenon known as photic driving of the electroencephalogram were employed in experiments with the ophthalmodynamometer and with positive acceleration on the human centrifuge. In both of these forms of stress when the intraocular pressure exceeded the retinal arteriolar diastolic pressure, a direct correlation was demonstrated to peripheral field constriction and loss of the previously apparent photic driving in the electroencephalogram. The latter did not reappear when the intraocular pressure exceeded the retinal arteriolar systolic pressure but did reappear as soon as the intraocular pressure was beneath the retinal arteriolar diastolic pressure. This suggests that photic driving is related to the rod portion of the human retina, since with retention of central vision, which is primarily a cone function, photic driving remained inhibited. Author

N63-12717 Naval Air Development Center. Aviation Medical Acceleration Lab., Johnsville, Pa.

EFFECT OF GRADIENT PRESSURE UPON PHYSIOLOGICAL SYSTEMS Report No. 1

Charles S. Mahan, W. S. Lovrinic, Wendell E. Jones, David P. Goldstein, Edward L. Beckman, and R. E. De Forest Dec. 28, 1962 33 p 20 refs

(NADC-MA-6218)

Dehydration is one of the serious problems resulting from prolonged water immersion following disasters at sea. This dehydration is aggravated by a marked diuresis which is apparently activated through the Gauer-Henry reflex. The effect of varying the temperature of the water from 95° to 75° F was evaluated with relation to the magnitude of this reflex-induced diuresis, both with and without replacement of fluid. A series of experiments was carried out involving four subjects immersed in water up to neck level for periods of four, six, and nine hours at a temperature of 75°, 85° and 95° F, respectively. This study showed that during partial body immersion at water temperature of 85° and 75° F with fluid replacement, the magnitude of the diuresis was the same for all temperatures. When the fluid loss was not replaced, the magnitudes of the diuresis, induced by immersion in 75° and 85° F water, were approximately equal and were about double the urinary output resulting from immersion in water at 95° F. This was attributed to the active peripheral vasoconstriction of the cold water. A gradual rise in urinary pH was observed during the period of the immersion. The urinary specific gravity decreased from over 1.020 to 1.001 - 1.005 at the onset of immersion. The urinary specific gravity remained low throughout the immersion period of the fluid replacement studies as well as the studies in 75° and 85° F water without replacement. The urinary specific gravity approached preimmersion values only in the 95° F immersion without

replacement. There was a consistent decrease in heart rate under the conditions of negative pressure breathing. The periods of immersion in water at 85° and 75° F caused a severe heat loss from the body as evidenced by a drop in body core temperature. This loss in body heat caused a drop in core temperature to below 95° F in some subjects immersed in water at 85° and 75° F for 2 hours. The currently held concept, that survival from disaster at sea when immersed in water at temperatures above 70° F is not limited by heat loss, becomes suspect in the light of these results. Author

N63-12738 Aerospace Medical Div. School of Aerospace Medicine, Brooks AFB, Tex.

STRESS RESPONSES OF PILOTS FLYING 6-HOUR OVERWATER MISSIONS IN F-104 AIRCRAFT

Vance H. Marchbanks, Henry B. Hale, and James P. Ellis Aug. 1962 10 p 13 refs

(SAM-TDR-62-112)

From postflight urine and blood samples, stress was appraised in two groups of pilots flying overwater missions of 6 hours' duration in F-100 or F-104 aircraft. Control determinations were made on a third group of pilots on an off-duty day. Urinary determinations included epinephrine, norepinephrine, corticosteroids (17-OHCS), sodium; potassium, inorganic phosphate, urea, uric acid, and creatinine. Blood determinations included free and conjugated hydrocortisone and corticosterone-like fractions. Flying raised corticosteroid levels in plasma but not in urine. Levels for the F-100 group were higher than for the F-104. Urinary epinephrine and norepinephrine values for the flying groups were significantly above those for the control, values for the F-104 group exceeding those for the F-100 group. Differences in flying groups appear to relate to aircraft characteristics, weather conditions, and flying experience. Both flying groups showed high urinary excretion of urea and uric acid, but only in the F-104 group was sodium and potassium excretion elevated. Flying induced no variation in urinary phosphate. Singly and collectively, these determinations are basic to future studies on flight stress. Author

N63-12739 Armour Research Foundation, Chicago, Ill.

RESEARCH ON FOG-RESISTANT MATERIALS FOR HIGH-ALTITUDE HELMET VISORS

Kurt Gutfreund Wright-Patterson AFB, Ohio, Life Support Systems Lab., Dec. 1962 49 p 16 refs

(Contract AF 33(616)-8076)

(AMRL-TDR-62-141) OTS: $1.25

Various methods of preventing visibility losses due to fogging of plastic MA-3 and HGU-8/P helmet visors in pressure suits were investigated. Hygrophilic film-forming polymers with polyhydroxyl groups were found to be promising fog-resistant coatings. Their effectiveness depends largely on the relative surface concentration of hygrophilic and hygrophobic groups, since these groups determine the proper balance between wettability and stability of the treatment on prolonged and intermittent exposure to fog-promoting conditions. Visors treated with 83% to 87% hydrolyzed polyvinyl acetate showed good overall optical properties. They exhibited little distortion, and their luminous transmittance and haze values were 92% and 0.4%, respectively. Enhancing the wettability of acrylic surfaces by ultraviolet irradiation and exposure in a thermal column of a nuclear reactor was ineffective. Also, preferential condensation of moisture in the helmet by gas-phase nucleation proved unsatisfactory for inhibiting fogging. Author

N63-12744 Aerospace Medical Div. School of Aerospace Medicine, Brooks AFB, Tex.

A STUDY OF PHOTOSTRESS AND FLASH BLINDNESS

Sanford L. Severin, Norris L. Newton, and James F. Culver Dec. 1962 10 p 4 refs

(SAM-TDR-62-144)

An experiment was designed to study the effects of pupillary size, flash intensity, testing patch luminance, and subject variability following photostress testing with intense light flashes. Fifteen subjects were exposed to illuminations ranging from 86,080 lux to 242,100 lux as measured at the corneal plane. Recovery was measured as the period of time required after dazzle to regain sufficient visual function to perceive a threshold discriminatory task. The experimental results are discussed and the operational significance is implied. Author

N63-12782 Aerospace Medical Div. School of Aerospace Medicine, Brooks AFB, Tex.

PROTECTION AGAINST IONIZING RADIATION: X-IRRADIATED MONKEYS RECEIVING PREIRRADIATION PROPHYLAXIS AND POSTIRRADIATION THERAPY

George S. Melville, Jr., George W. Harrison, Jr., Thomas P. Leffingwell, Walter H. Whitcomb, and Robert J. Young Dec. 1962 14 p 9 refs

(SAM-TDR-62-103)

In this study, postirradiation symptomatic therapy of the radiation syndrome has been utilized to provide significant extension of survival time, compared to irradiated controls, of Macaca mulatta primates X-irradiated to a total dose of 900 r. Further, the therapeutic regimen has been successfully combined with chemical radioprotectants to enhance survival time in a third group of animals. This combined treatment is more effective than the therapy alone. The overall clinical condition of these animals is far superior to that of the untreated irradiated animals. Pathologic studies of the deceased animals indicate that the two major causes of death were bone marrow failure and severe lymphoid atrophy. The protective chemical treatment is in itself a combination of different mechanisms of radioprotection, routes of administration, and sites and rates of absorption of the drugs. Author

N63-12796 Corbin-Farnsworth, Inc., Palo Alto, Calif.

PROPOSAL FOR STUDY AND DEVELOPMENT OF REMOTE BLOOD PRESSURE MEASURING SYSTEM First Quarterly Report

Dec. 15, 1962 5 p

(NASA Contract NASw-493, Extension of NASA Contract NASr-35)

OTS: $1.10 ph, $0.80 mf

Progress in development of a remote blood pressure measuring system includes: improving the occluding earpiece and the driving solenoid for the occluding system; determining the tracking ability of the bellows on the earpiece and the fidelity of the transduced pressure waveform; attempts at developing diastolic pressure point indications; and continued efforts to help overcome system inaccuracy by building the occluding earpiece with minimum spring rate and maximum travel. B.J.C.

N63-12824 National Research Council. Committee on Hearing and Bio-Acoustics, Washington, D.C.

CHABA—1962. ANNUAL REPORT OF THE NATIONAL RESEARCH COUNCIL COMMITTEE ON HEARING AND BIO-ACOUSTICS, JANUARY-DECEMBER, 1962

Milton A. Whitcomb Feb. 1963 35 p

The material covered at the meeting included: military audiology; calibration and environmental standards; ear protection; calculation of noise level; and biological effects of jet and rocket noise. R.C.M.

N63-12825 Naval School of Aviation Medicine, Pensacola, Fla.

CONDUCT RESEARCH ON THE EFFECT OF VERY STRONG FIELDS AND OF MAGNETIC FIELD-FREE ENVIRONMENTS ON MAN AND ANIMALS Progress Report, Nov. 1, 1961-Jan. 31, 1962

D. E. Beischer Jan. 29, 1962 3 p
(NASA Order R-39)
OTS: $1.10 ph, $0.80 mf

Conduct research on the effect of very strong magnetic fields and of magnetic field-free environments on man and animals was reviewed. Results are as follows: (1) Experiments on mice demonstrated that a mammal is not visibly affected by short exposure to magnetic fields of the highest intensity presently available or by fields with high gradient. (2) Drosophilia survived after exposure to homogeneous fields up to 120,000 gauss. However, lethal effects were observed in all experiments in which the flies were exposed to an inhomogeneous field with a gradient higher than about 6,000 gauss per centimeter. It may be presumed that the pumping effect of the inhomogeneous field, which removes paramagnetic oxygen from the tracheae causes death of the flies. (3) Experiments on the development of sea-urchin eggs and the survival of bacteria are not yet conclusive. Preparations are nearly completed for a prolonged exposure of two human subjects in the magnetic coil systems of the Naval Ordnance Laboratory, White Oak, Silver Spring, Maryland. The experiment is designed to simulate the magnetic environment on the surface of the moon, which is expected to be magnetically nearly quiet (below 50 gamma). The preparations require the exclusion of all materials with high magnetic permeability from personal belongings and equipment that enter the Helmholtz coil system. I.v.L.

N63-12834 American Inst. of Biological Sciences, Washington, D.C.
THE AIBS BULLETIN, VOLUME XII, NUMBER 5, OCTOBER 1962. SPECIAL SPACE-BIOLOGY ISSUE
Hiden T. Cox, ed. [1962] 124 p

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N63-12835 National Aeronautics and Space Administration, Washton, D.C.
THE NASA SPACE EDITION
Hugh L. Dryden *In* AIBS Bulletin, v. 12, no. 5, Oct. 1962 p 23 (See N63-12834 06-16)

Although scientists are reasonably well informed in their own field of interest through the disciplinary journals, communications often falter in the interdisciplinary fields. Because coverage of the scientific aspects of space activities is not uniformly available in the mass media, the majority of American scientists are dependent upon less-than-adequate coverage. Therefore NASA and the American Institute of Biological Sciences are attempting to communicate a rounded picture of the space effort to the Nation's scientists. M.P.G.

N63-12836 National Aeronautics and Space Administration, Washington, D.C.
SPACE BIOSCIENCES
Orr E. Reynolds *In* AIBS Bulletin, v. 12, no. 5, Oct. 1962 p 49-51 (See N63-12834 06-16)

The biologist's task in space is considered to fall into three categories: (1) the search for extraterrestrial life; (2) the biological engineering of putting man into space adequately protected from space hazards and sustained by a good simulation of his terrestrial environment; and (3) the exploitation of special features of the space environment for the general analysis of organism-environment relationships. The first objective is considered to the most important because of its philosophical implications concerning the meaning of life and man's place in nature. Major developments required for carrying out these objectives include: the design of highly reliable flight systems adapted to biological experiments; the integration of experimental biologists with physicists and engineers to achieve the maximum collection of reliable data; and the rapid development of biological theory and concept so that experimental design for space biology will be more certain of answering the pertinent questions. M.P.G.

N63-12837 National Aeronautics and Space Administration, Washington, D.C.
LIFE SUPPORT AND MANNED SPACE FLIGHT
Charles H. Roadman and Frank B. Voris *In* AIBS Bulletin, v. 12, no. 5, Oct. 1962 p 53-55 (See N63-12834 06-16)

The problem of developing a manned vehicle for space is one of engineering reliable life-support systems into a sealed capsule that will ensure an environment in which the astronaut can maintain his technical proficiency. Current and proposed methods of controlling capsule pressures, gases, and temperatures are discussed, as well as techniques of positioning and restraining the astronaut for acceleration and weightlessness conditions. Current thought on supplying food and water, removing human waste, and maintaining blood circulation and muscle tone on prolonged flights is reviewed. M.P.G.

17 MACHINE ELEMENTS AND PROCESSES

Includes: bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; and materials fabrication, handling, and inspection.

For related information see: 06 Auxiliary Systems.

N63-12367 Frankford Arsenal. Pitman-Dunn Labs., Philadelphia, Pa.
ELECTROLESS NICKEL PLATING. CORROSION RESISTANCE AND THICKNESS DETERMINATIONS
Fred Pearlstein Oct. 1962 7 p 2 refs Repr. from Metal Finishing, Apr. 1962
(A62-12)

The corrosion resistance of steel coated with nickel from several electroless plating solutions was determined. Panels plated from the acid citrate-acetate bath had the greatest resistance to corrosion. The thicknesses of electroless nickel-plated panels were determined by weight-density calculations, magnetic gauge readings, and microscopic cross-section examinations. The thickness values agreed within about 13 percent of each other. Author

N63-12370 Ampex Corp., Redwood City, Calif.
GAS-LUBRICATED SLIDER BEARINGS
Robert Peyton Nov. 1962 53 p 19 refs
(TR-62-8; UC-270)

The objective of this study has been to determine a method of maintaining a precise space between two surfaces. One of the most promising ways is by supporting one surface on a self-lubricating slider bearing. The report gives a qualitative description of the hydrodynamic lubrication process and quantitative information on several types of sliders. It is apparent, although not proven here, that a pivot-loaded, curved-step slider bearing is the most desirable type for this purpose. The range of available surface speeds under atmospheric conditions is from 500 to 5000 ips, or to the burst strength of the rotating material. Loads of about one atmosphere may thus be supported at a space of 60 to 100 μin. These spacings may be held easily within ±1 percent. This, of course, depends on keeping the slider mass small. The lubricating film acts as a spring, with a rate on the order of 10^5 lb./in. per square inch of slider surface. Author

N63-12405 Space Technology Labs., Inc., Redondo Beach, Calif.
OGO SOLAR ARRAY DRIVE AND SHAFT SUPPORT BEARING TESTS
J. C. Heindl and R. J. Belanger Sept. 20, 1962 82 p
(TR 2311-6026-RU000)

A series of tests were performed to provide design information on materials and lubricants for ball bearings to be used in the space environment. The loads, speeds, and modes of operation were chosen to be representative of those anticipated in the OGO Solar Array Drive and Shaft Support Bearings. Both R-4 size and 1-13/16-in ID bearings were tested at 10^{-7} mm of Hg and speeds of from 1 to 4 rpm for one month with instantaneous torques automatically recorded. The bearings were all 440C CRES alloy. The retainer materials tested included sintered bronze, 416 CRES, Delrin, DUROID 5813, and a phenolic. The lubricating coatings investigated were gold plating, molybdenum disulfide, and a vacuum deposited multilayer film, CBS Laboratories'#CDL5940. The results indicated the most satisfactory performance was obtained using gold-plated balls, races, and a gold-plated 416 CRES retainer, all burnished with MoS_2 in conformance with STL Process Specification PR1-1. Author

N63-12474 Naval Radiological Defense Lab., San Francisco, Calif.
A CONTINUOUS SCAN SCINTILLATION SYSTEM FOR THE INSPECTION OF TUNGSTEN BILLETS
H. A. Zagorites and K. F. Sinclair Dec. 10, 1962 23 p 7 refs
(USNRDL-TR-602)

A continuous scan system, employing a 200 curie Co^{60} source, scintillation detection of transmitted radiation, differential d.c. amplification and strip-chart recording, has been applied experimentally to the inspection of tungsten billets used in the fabrication of nozzles for solid-propellant rocket motors. The results of a detailed inspection of an uninfiltrated billet, supplied during the first phase of a round robin among a manufacturer and several Navy laboratories, were in agreement with radiographic data obtained during an earlier inspection. With this billet, the volume sensitivity of the system was measured to be about 5.0×10^{-2} cm^3, which was within a factor of two of the predicted sensitivity of 2.7×10^{-2} cm^3. The experimental work showed the feasibility of the continuous scan method as a primary inspection method for the inspection of tungsten billets and clearly demonstrated its usefulness in the present state of development as a supplement to film radiography. Author

N63-12591 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
BOUNDARY LUBRICATION CHARACTERISTICS OF A TYPICAL BEARING STEEL IN LIQUID OXYGEN
William F. Hady, Gordon P. Allen, and Robert L. Johnson Washington, NASA, Feb. 1963 16 p 10 refs
(NASA TN D-1580) OTS: $0.50

Friction and wear data were obtained with a typical bearing steel (AISI 440-C) at conditions approximating those encountered by bearings and seals in rocket engines using liquid oxygen as the lubricant. A 3/16-in.-radius hemisphere was loaded against the flat surface of a rotating disk at sliding velocities from 250 to 8000 ft/min and loads from 200 to 1500 grams. Fundamental boundary lubrication characteristics of liquid oxygen show the importance of surface-reaction films. The experiments described herein demonstrate the validity of the adhesion concept of friction and wear. Author

N63-12636 Union Carbide Nuclear Co., Oak Ridge, Tenn.
SHORT-ARC WELDING OF HASTELLOY N (INOR-8)
H. B. Harlan and V. B. Gritzner Feb. 4, 1963 27 p 4 refs
(Contract W-7405-eng-26)
(Y-1409) OTS: $0.50

Experiments were conducted to compare, evaluate, and determine if the shielded-inert-gas, consumable-electrode, short-circuit welding process would offer advantages over the shielded-inert-gas, tungsten-arc welding process for fabricating Hastelloy N(INOR-8) materials. Filler wire for all experiments using the shielded-inert-gas, consumable-electrode welding process failed to meet the weldability tests required for the shielded-inert-gas, tungsten-arc process. This filler wire had been obtained to accomplish nuclear quality weldments in construction of a molten salt reactor. Results of these experiments showed that ductile welds with no cracking or fissuring could be accomplished approximately eight times faster by the semiautomatic consumable-electrode process than when using the manual tungsten-arc process. However, porosity was found in all test experiments using the consumable-electrode process. This porosity could be controlled to meet the Unfired Pressure Vessel Code (Section VIII, Appendix IV, Porosity Charts, ASME Boiler and Pressure Vessel Code). Author

N63-12644 European Atomic Energy Community, Brussels (Belgium)
SWAGING OF URANIUM DIOXIDE Annual Report
G. Frigerio FIAT—Sezione Energia Nucleare, Torino, [Dec.] 1962 45 p 5 refs
(Contract Euratom 059-61-7-RDI; Euratom-United States Agreement for Cooperation)
(EUR 117.e) Available from Belgian American Bank and Trust Co., N.Y., account No. 121.86; 50 Belg. Fr.

A study was made on a small pilot plant scale of the reproducibility of data obtained with the following vibroswaging process: pneumatical vibration (4 minutes duration) to reach a UO_2 density of approximately 84% of theoretical, followed by two passes through the swager without intermediate annealing for a reduction of total area of approximately 18%. More than one hundred rods of reactor length (125 to 190 cm) were fabricated. For both stainless steel and Zircaloy-2 rods the reproducibility of the UO_2 average density was 92.5% ± 0.5% T.D. Spread of density values along the rod length referred to the average density was +0.5% to 1.5% T.D. or better. Spread of final active length was ± 1.3 cm or better. From the present work, indicative conclusions can be drawn on the fabrication cost of the vibroswaged UO_2 fuel as compared to the pelletized UO_2 fuel. A "stationary" technique was chosen for measuring the out-of-pile thermal conductivity of swaged UO_2. Assuming as a comparison base the values reported by Deem and Lucks for UO_2 pellets, the thermal conductivity values for swaged UO_2 seem to remain lower by approximately 25% than the thermal conductivity values for pellets at the same density (90% T.D.) and at temperatures between 150°and 800°C. Author

N63-12688 Aerospace Information Div., Library of Congress, Washington, D.C.
LOCALIZED DIE FORGING OF ALUMINUM PANELS
Jan. 30, 1963 4 p Review of: N. G. Yevlanov, I. M. Rynskiy, and M. Ya. Kuleshov Manufacturing of panels by a method of localized die forging Kuznechno-shtampovochnoye Proizv. (USSR), no. 11, 1962, p 1-5
(AID-S-63-19) OTS: $1.10 ph, $0.80 mf

Localized die forging is suggested for the manufacture of ribbed aluminum alloy panels. In localized die forging, the entire panel is forged at one time, but (unlike conventional forging) forging pressure is concentrated in areas that are more difficult to shape than the rest of the panel. Localized forging can be performed in one or two steps, depending on panel size and shape. The same bottom die but differently shaped top dies are used for each step. In some cases, higher ribs were obtained in one step than can be obtained in two steps by conventional forging. Panels forged by this method had clean surface finishes, and their precision met specifications with higher metal utilization and lower cost. This method could also be applied to the production of integrally stiffened panels from materials other than aluminum. M.P.G.

N63-12725 Hanford Atomic Products Operation, Richland, Wash.
ULTRASONIC LAMB-WAVE PROPAGATION MODELS FOR NON-DESTRUCTIVE TESTING APPLICATIONS
C. E. Fitch Oct. 1962 38 p 7 refs
(Contract AT(45-1)-1350)
(HW-75499) OTS: $1.00

Basic Lamb-wave propagation formulas are presented. The propagation equations leading to the type of Lamb mode vibration explained in terms of net particle vibrations in, and perpendicular to, the direction of Lamb-wave travel are repeated after Worlton. A technique for separating Lamb waves into longitudinal and shear wave components was developed, and formulas for amplitude ratios are presented. The net particle movement for Lamb-wave phase velocities, V, greater than the Zircaloy longitudinal velocity, V_l, is shown to be the combined effects of a pair of longitudinal and a pair of shear waves. For phase velocities between V_l and the shear velocity, V_s, the situation is not clear since the longitudinal waves convert to boundary-layer waves which are not easily explained physically. To demonstrate the existence of the four waves for $V > V_l$, Zircaloy plates vibrating in the Lamb-wave domain were observed using the Schlieren image technique which is briefly described. Future work is discussed. Author

N63-12740 Argonne National Lab., Ill.
HELIUM-PURIFICATION UNIT FOR HIGH-PURITY INERT-ATMOSPHERE BOXES
M. S. Foster, C. E. Johnson, and C. E. Crouthamel Dec. 1962 19 p
(Contract W-31-109-eng-38)
(ANL-6652)

A device for purifying and recycling the helium atmosphere of two dryboxes having a combined volume of 60 ft^3 is described. Trace impurities are removed by passing the helium through a palladium-catalyst container and a molecular sieve bed, and then cooling to −195° C before passing through an activated charcoal bed. Flow rates of 10 scfm and purity levels are estimated. Regeneration procedures are given. Author

N63-12784 Picatinny Arsenal. Ammunition Group, Dover, N.J.
DEVELOPMENT OF A MODULAR MECHANICAL PROGRAMMER
Matthew J. Dujets Jan. 1963 37 p
(Tech. Memo. DW-433)

The problem of selecting an optimum design for a warhead fuze system is usually complicated by the fact that system requirements remain undefined until development of the propulsion system is near completion, thus foregoing any extensive development program on the fuze itself. This report presents a modular approach to the fuze design problem by providing a compatible "building block" programer made up of individual units which perform specific tasks. Once interchangeable modules capable of performing definite functions have been developed, approximately 80% of the specifications for any missile system can be met by an appropriate choice of the "off the shelf" modules. Consequently, all of the effort can be concentrated to fulfill the remaining requirements. Also, developmen and improvement of individual modules can continue without interruption in order to incorporate desirable state-of-the-art advances Autho

N63-12821 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
CUTTING TOOLS, FIRE, WATER, POWDER
B. Zubkov Nov. 9, 1962 15 p Transl. from Znanie Sila (USSR), v. 36, no. 11, 1961 p 11-14
(FTD-TT 62-1357/1)

Machining processes are discussed: rocket torches, explosive cutting, electrochemical, ultrasound, electron-ray gun, and hydro-erosion. R.C.M.

18 MATERIALS, METALLIC

Includes: cermets; mechanical and physical properties of alloys and metals; and metallurgy.

For related information see: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Non-metallic; 33 Stresses and Loads; and 34 Structural Design.

N63-12375 Bureau of Mines. Boulder City Metallurgy Research Lab., Nev.
EXPERIMENTS IN FUSED-SALT ELECTROLYSIS OF TUNGSTEN
F. R. Cattoir 1963 14 p 8 refs
(BM-RI-6154)

This report presents the results of preliminary studies for the evaluation of some fused-salt electrolytes for refining tungsten metal, and describes the equipment used. Some impurities could be eliminated with electrolytes composed of sodium chloride, sodium iodide, or sodium tetraborate in combination with tungstic oxide or sodium tungstate. Electrolytes composed entirely of chlorides were unusable because of the volatility of tungsten chloride. Refining 96- to 98-percent tungsten to produce a commercial grade was more successful than further refining of 99.9-percent tungsten. No electrolyte tested yielded a product pure in all respects. Electrolyte temperatures of about 900° C were necessary to maintain a good dissolution rate at the anode and acceptable cell operation. Cathode current densities at the beginning of a deposition cycle were limited to approximately 1 ampere per square inch. Higher current densities resulted in a finely divided product that frequently failed to adhere to the cathode. The most conspicuous impurities in the tungsten produced were carbon, iron, and molybdenum; the former two came from the iron cell and the graphite cell liner. Electrolytes composed of tungstic oxide or sodium tungstate in sodium iodide, or $2Na_2O.B_2O_3$, were capable of producing tungsten carbide. Author

N63-12376 Armour Research Foundation, Chicago, Ill.
DEVELOPMENT AND APPLICATION OF A THEORY FOR PLASTIC DEFORMATION OF CEMENTED ALLOYS TASK 1: ZONE REFINING OF CEMENTED TUNGSTEN-BASE ALLOYS [Second] Quarterly Report, October 1, 1961-December 31, 1961
N. M. Parikh Jan. 29, 1962 16 p
(Contract DA-11-022-505-ORD-3092)
(WAL-TR-372/32-3-T1)

A series of experiments were made to scale-up the current effort in order to produce large tungsten sheets. A 600-lb block of W-Ni-Fe powder was prepared by hydrostatic pressing. Twelve-inch square

slabs (one inch thick) were cut from this block and sintered. Some were warm rolled and subjected to zone refining treatment by electron beam heating. The details of the experimental results are discussed. Author

N63-12377 Armour Research Foundation, Chicago, Ill.
DEVELOPMENT AND APPLICATION OF A THEORY FOR PLASTIC DEFORMATION OF CEMENTED ALLOYS. TASK 3. COPPER-COOLED TUNGSTEN FIBER ROCKET NOZZLE MATERIALS [Second] Quarterly Report, October 1, 1961-December 31, 1961
T. J. Koppenaal Jan. 29, 1962 12 p
(Contract DA-11-022-505-ORD-3092)
(WAL-TR-372/32-3-T3)

The copper-nickel ratio used as a matrix material has been investigated in 75% density tungsten fiber composites made from one- and two-mil-diameter fibers. The ductility in tension and compression was evaluated. The use of Si as an additive to the matrix was examined in an attempt to improve the ductility in tension. Author

N63-12380 Battelle Memorial Inst., Columbus, Ohio
INVESTIGATION OF MECHANICAL PROPERTIES OF CHROMIUM, CHROMIUM-RHENIUM, AND DERIVED ALLOYS Eleventh Quarterly Progress Report [1 Sept.-30 Nov. 1962]
A. Gilbert, B. C. Allen, C. N. Reid, and G. T. Hahn Dec. 31, 1962 13 p 10 refs
(NASA Contract NASw-101)
OTS: $1.60 ph, $0.80 mf

Pure chromium (ICr-4) has been tested for tensile and impact behavior in the range 0° to 400° C. Introducing a notch caused the transition of wrought chromium to rise by 256° C and that of recrystallized chromium by 340° C. Pure chromium was prepared by induction melting a compact of ICr-4 crystals in an atmosphere of purified hydrogen. This technique appears to be capable of producing fairly large quantities of chromium rod. R.C.M.

N63-12477 Ames Lab., Iowa State U. of Science and Tech.
GROWTH OF SINGLE CRYSTALS OF LEAD, CADMIUM AND BISMUTH USING THE BRIDGMAN METHOD Research and Development Report
James Herriott, Morton Smutz, and Edwin H. Olson Nov. 1962 24 p 4 refs
(Contract W-7405-eng-82)
(IS-542) OTS: $0.50

The Bridgman technique was used to grow single crystals of lead, cadmium and bismuth about ½ in. in diameter and 3 in. long. Rigid quartz or graphite molds were found to be satisfactory for growing single crystals of lead and cadmium, but a "soft mold" was needed in order to grow single crystals of bismuth. Lowering speeds of approximately ⅓ in. per hr were used in the bismuth runs. Lowering speeds of 2 in. per hr could be used with cadmium and 3 in. per hr with lead. Two techniques are described for coping with the tendency of bismuth to supercool which results in rapid crystal growth after nucleation. Author

N63-12490 Naval Radiological Defense Lab., San Francisco, Calif.
THERMAL DIFFUSIVITY AND HEAT CAPACITY MEASUREMENTS AT LOW TEMPERATURES BY THE FLASH METHOD
O. Makarounis and R. J. Jenkins Nov. 19, 1962 20 p 1 ref
(USNRDL-TR-599)

A method for measuring heat capacity and thermal diffusivity of solid materials from −180° C to +200° C is described. A high-intensity short-duration light pulse is absorbed in the front surface of the specimen, and the resulting temperature rise of the rear surface is measured by a thermocouple, displayed on an oscilloscope and photographed by a Polaroid Land camera. From the shape and magnitude of the temperature traces thus obtained, the thermal diffusivity and heat capacity of the specimen are determined. Thermal properties of aluminum alloy No. 2024 and single crystal magnesium oxide were determined with this method over the temperature range from −180° C to +200° C. Author

N63-12578 Illinois U., Urbana
Progress Report—Status of Work Jan. 31, 1962 [INTERACTIONS IN METAL CRYSTALS AND KINETICS OF METAL OXIDATION REACTIONS]
Charles Wert [1963] 6 p
(Contract AF 33(616)-6176)

Metallurgical research is reported in the following areas: cold-work peaks in body-centered cubic (bcc) metals; interstitial-interstitial interactions in bcc alloys; geometry of clusters; and thermodynamics of reactions between oxygen and nitrogen with niobium, tantalum, and vanadium. R.C.M.

N63-12583 Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio
JOINING OF NICKEL-BASE ALLOYS
R. M. Evans Dec. 20, 1962 77 p 60 refs
(Contract AF 33(616)-7747)
(DMIC-181)

The key to the success of many devices that are to be used in corrosive or high-temperature environments is often an ability to properly weld the nickel-base alloys. Alloys such as Monel, Inconel, etc., that do not depend upon relatively complex metallurgical reactions to obtain their desirable properties are not difficult to weld if proper procedures are used. Alloys which are relatively new (René 41, Hastelloy R-235, Inconel X, etc.) and do depend on complex metallurgical reactions to develop their useful properties present many joining problems. This report covers in a general way the criteria for the successful fabrication of several alloys which fall in each category. Fusion welding, resistance welding, and brazing are covered. The welding of dissimilar nickel-base-alloy combinations and repair welding are also discussed. Author

N63-12603 Los Alamos Scientific Lab., N. Mex.
THERMODYNAMIC FUNCTIONS FOR PURE PLUTONIUM
Robert N. R. Mulford Jan. 29, 1963 13 p 12 refs
(Contract W-7405-eng-36)
(LA-2813) OTS: $0.50

Values for heat capacity, enthalpy and entropy increments, free energy function, vapor pressure, and heat and entropy of vaporization for solid and liquid plutonium at temperatures from 298.16° to 2500° K are tabulated. Heats of transition are also included. Author

N63-12615 Rice U., Houston, Tex.
NONELASTIC STRAIN RECOVERY IN ZINC SINGLE CRYSTALS
J. M. Roberts and N. Brown (Penn. U) New York, Oxford, London, Paris, Pergamon Press, 1963 11 p 33 refs Repr. from Acta Met., v. 11, no. 1, Jan. 1963 p 7-16
(NASA Grant NsG-6-59)

The rapid and time dependent strain recovery which occurs in deformed zinc single crystals has been studied as a function of prestrain, specimen purity, and surface condition. The total strain recovery of zinc crystals was found to increase with prestrain for a constant unloading rate or to increase when the surface is copper coated over that for an uncoated crystal at equal prestrains greater than 10^{-4}. Doping zinc with cadmium is found to decrease the amount of total strain recovery as compared to undoped crystals at equal prestrains greater than 10^{-3}. The recovered strain under various conditions was found to be logarithmic in time at constant applied stress. The time dependent recovery is explainable as a creep recovery process, the inverse of the transient creep behavior discussed by Seeger. The increase of the total strain recovery with prestrain can be accounted for by an increase of dislocation density with prestrain. Only cadmium

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doped crystals were observed to exhibit a jerky unloading behavior at room temperature and after a certain prestrain. This jerky unloading behavior is similar to the Portevin-Le Chatelier effect in iron and aluminum alloys as explained by Cottrell. The surface effect results suggest that a uniform increase in dislocation density may proceed from the center to the outside of the crystal after prestrain. The internal stress associated with this type of dislocation configuration may be expected to relax almost linearly with the recovered strain. Author

N63-12616 Rice U., Houston, Tex.

CLUSTERING KINETICS IN BINARY ALLOYS

R. Asimow Repr. from Acta Met., v. 11, no. 1, [Jan.] 1963 p 72-73 4 refs

(NASA Grant NsG-6-59)

A formula is derived which can be applied to many quenched binary alloy systems to estimate the precipitate particle size as a function of aging time. Based on Greenwood's assumption that there is a concentration gradient in the vicinity of each particle which causes it to either grow or shrink, depending on the size of the particle and the mean solute concentration, the sphere of influence of each particle is expressed as a fraction of the total volume. Since the total solute concentration remains unchanged during the precipitation process, the rate of change of radius of any particle is expressed as a function of the radius, the fraction precipitated, the ratio of the solubility at the aging temperature to the total solute concentration, the total number of precipitate particles, and temperature. M.P.G.

N63-12668 Israel Inst. of Tech., Haifa

EFFECT OF ORDER-DISORDER PHENOMENA ON THE STRENGTH OF HIGH TEMPERATURE ALLOYS Scientific Note No. 10. Final Report

P. S. Rudman Sept. 1961 6 p 9 refs

(Contract AF 61(052)-122)

(ARL-225)

Investigation of order-disorder phenomena on the strength of high-temperature alloys encompassed: (1) the Fe-Al phase diagram; (2) a description of an X-ray technique developed for obtaining the orientation of individual grains in polycrystalline sheet; (3) the reason for the existence of order in the Fe rich Fe-Al alloys from the point of view of electron band theory; (4) the kinetics of the transformation FeAl order $\rightleftharpoons$ Fe_3Al, including the development of a general theory of vacancy mechanics and a study of the kinetics by electrical resistivity measurements showing the dominant influence of excess quenched-in vacancies in the ordering kinetics; (5) general calculations concerning order-strengthening mechanisms which include a new mechanism of order-strengthening, an X-ray diffraction study of long-range order in some alloys in the neighborhood of the composition of Fe_3Al, and a calculation of the contribution of short-range order to the shear stress in a long-range ordered phase; and (6) a study of the effect of quenching temperature on the room-temperature deformation behavior of alloys near the composition of Fe_3Al. Results indicated that the features of the ordering behavior and the effect of order on the strength properties of these alloys were obtained. I.v.L.

N63-12712 Nuclear Metals, Inc., Concord, Mass.

BERYLLIUM RESEARCH AND DEVELOPMENT PROGRAM Quarterly Progress Report for the Period July 1, 1962 through September 30, 1962

S. H. Gelles Jan. 28, 1963 67 p 6 refs

(Contract AF 33(616)-7065)

(NMI-9525)

Beryllium research investigations presented are: (1) a study of the brittle of beryllium by means of electron microscopic transmission; (2) metallurgical factors affecting the ductile-brittle transition in beryllium; (3) preparation of ultrafine beryllium powder; (4) preparation and evaluation of fine-grained beryllium; (5) recrystallization and grain growth in beryllium; (6) identification of impurities and precipitates in beryllium; (7) preparation and evaluation of high-purity beryllium; and (8) fabrication and evaluation of fine-grain beryllium produced from ultrafine powders. I.v.L.

N63-12719 Rolla Metallurgy Research Center, Bureau of Mines, Mo.

EFFECT OF INDIUM ON THE SOLID SOLUBILITY OF CALCIUM AND OF SILICON IN MAGNESIUM

R. L. Crosby and K. A. Fowler 1963 15 p 3 refs

(BM-RI-6170)

The effect of indium on the solid solubility of calcium and of silicon in magnesium was studied using metallographic, X-ray diffraction, and electrical resistivity techniques. The addition of 2 weight-percent or more of indium reduced the solid solubility of calcium in magnesium by forming a compound containing indium and calcium. Indium additions have no perceptible effect on the solid solubility of silicon in magnesium. Author

N63-12730 Sylvania Electric Products, Inc. Chemical and Metallurgical Div., Towanda, Pa.

DEVELOPMENT AND PRODUCTION OF IMPROVED MOLYBDENUM SHEET BY POWDER METALLURGY TECHNIQUES Final Report, 1 Oct. 1959—30 Sept. 1962

Roger B. Bargainnier, Richard F. Cheney, and Lauri D. Tiala Jan. 31, 1963 101 p 10 refs

(Contract NOA(s)-60-6018-c)

A powder-metallurgical molybdenum alloy was developed which, in wrought form, has properties as good as or better than those of arc-cast Mo-0.5Ti. The alloy, Mo-0.5Ti-0.03C (MTC), was selected after screening 15 molybdenum-alloy systems. Process specifications for 40-mil MTC sheet were developed. In the as-rolled condition the sheet has an ultimate tensile strength at 1200° C of about 60 ksi. It is approximately 50% recrystallized after one hour at 1210° C, and its ductile-brittle transition temperature is below room temperature. The MTC seems to be responsive to strain-induced precipitation strengthening in a manner similar to that ascribed by other investigators to certain arc-cast molybdenum alloys. Sintering at $\geq$1850° C is necessary to develop the best properties in MTC sheet. A process was also developed for rolling molybdenum powder directly to sheet. Author

N63-12733 Minnesota U. Inst. of Tech., Minneapolis

ON THE ZENER EFFECT IN ALLOYS. I. THE SIZE FACTOR Technical Report No. 6

J. M. Sivertsen Sept. 15, 1962 24 p 9 refs

(Contract Nonr-710(29))

The problem of the stress-induced ordering of solute atoms, the so-called Zener effect, is considered. In this work, the effect of the difference in solute-solvent atom sizes is considered. Starting with this size factor the tensor anelastic strain is computed. Then by the thermodynamic theory for relaxation processes, due Meixner and others, the relaxation strength, Δ_M, is calculated as a function of orientation. The results of the calculation suggest that the size factor is not necessarily the most important contribution in determining the relaxation strength. It is suggested that electronic effects may be more significant. Author

N63-12768 Armour Research Foundation, Chicago, Ill.

CO-REDUCTION AND CONSOLIDATION OF Mo-0.5Ti-0.1C ALLOY Final Report, Apr. 27, 1961-Oct. 31, 1962

John J. Rausch and Charles R. Simcoe Feb. 4, 1963 33 p 2 refs

(Contract NOw-61-0548-c)

(ARF-B224-5)

Coreduction of preblended halides by a modified Kroll Process has been investigated as a means of producing prealloyed Mo-Ti-C powders. Processing parameters were varied in an attempt to produce a composition similar to that of commercial Mo-0.5Ti alloy.

This was successfully accomplished except for an abnormally high oxygen content. The oxygen present in the material caused compositional variations during subsequent processing and resided as a finely dispersed Mg-Ti-O phase. The alloys, after sintering, were extremely fine grained and were readily hot and cold workable. A bend-transition temperature below −80° F was determined for one lot of material in the partially recrystallized condition. Tensile properties were similar to those of the commercial alloy at 2000° F; however, the recrystallization temperature was considerably lower. Author

N63-12780 Bureau of Mines. Berkeley Thermodynamics Lab., Calif.

HIGH-TEMPERATURE HEAT CONTENTS AND ENTROPIES OF THE SESQUIOXIDES ERBIUM, HOLMIUM, THULIUM, AND YTTERBIUM

L[ouis] B. Pankratz and E[dward] G. King 1963 12 p 8 refs
(BM-RI-6175)

The heat contents of the sesquioxides of erbium, holmium, thulium, and ytterbium in the cubic crystalline form were measured over the temperature range from 298° to 1,800° K. The erbium and holmium sesquioxides gave regular heat content-temperature curves. Thulium sesquioxide had a minor thermal anomaly near 1,680° K, with a heat absorption of 310 cal/mole; similarly, ytterbium sesquioxide had a minor anomaly near 1,365° K, with a heat absorption of 150 cal/mole. The heat-content results are presented in both tabular form (at 100° intervals) and in algebraic form. Entropy increments, corresponding to the tabulated heat-content results, also are listed. Author

N63-12801 Armour Research Foundation, Chicago, Ill.

AN INVESTIGATION OF METAL REINFORCED LEAD Quarterly Report, October 1 to December 31, 1962

H. Schwatzbart, John F. Rudy, N. Bredzs, and M. H. Zoiss Jan. 28, 1963 18 p 1 ref
(ARF-B765-25)

This report summarizes the results of experiments on the development of two lead-base products having commercial applications: metal fiber reinforced soldering tape and metal fiber reinforced bearings. The soldering-tape investigations to determine the optimum density of the steel fibers impregnated with lead-tin alloys have been continued. Several fluxing procedures, including soldering in air without any external fluxes, were studied. The bearing test-program results thus far indicate that reinforcement by the fibrous steel network extends bearing life 50 to 75 percent. Author

19 MATERIALS, NONMETALLIC

Includes: mechanical and physical properties of non-metals (e.g., plastics).

For related information see: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N63-12406 Battelle Memorial Inst., Columbus, Ohio

INVESTIGATION OF SINTERABLE MgO POWDERS AND CERAMICS MADE FROM THEM Technical Documentary Report [Jan. 1, 1961-May 31, 1962]

M. J. Snyder, A. Rudnick, W. H. Duckworth, and C. Hyde Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Oct. 1962 55 p 27 refs
(Contract AF 33(616)-7733)
(ASD-TDR-62-700)

The fabrication of dense reproducible specimens suitable for strength measurements and having controlled microstructural differences was attempted. A sinterable high-purity magnesia powder, developed in an earlier phase of the program, was used. Procedures used earlier to produce small, rather crude specimens, could not be applied directly to controlled production of the quantity of large specimens needed. The sintered densities of the larger specimens were lower, and the variability from one lot to the next was greater. The major source of variability appeared to reside in the isostatic pressing operation. This unexpected sensitivity to forming conditions other than pressure suggests the need for further research on processing effects in ceramics made from sinterable powders. A portion of the effort was devoted to analysis and development of the diametral-compression test wherein short cylinders are broken by applying a load across a diameter. Procedures were established for measuring a tensile strength by this method. Author

N63-12412 Hanford Atomic Products Operation, Richland, Wash.

RADIATION DAMAGE IN GRAPHITE BY HIGH ENERGY ELECTRONS

I. T. Myers Oct. 29, 1962 12 p 12 refs
(Contract AT(45-1)-1350)
(HW-75428) OTS: $0.50

Measurements of radiation damage were made in NPR and KC graphite, using a 2 Mev Van de Graaff electron accelerator as a radiation source. These included measurements of length changes, lattice spacing changes, and resistivity changes upon electron irradiation. It was found that significant quantities of ozone were produced when irradiations were done using liquid nitrogen as a coolant. Author

N63-12428 Borden Chemical Co. Central Research Lab., Philadelphia, Pa.

STUDY LEADING TO THE DEVELOPMENT OF REINFORCED HIGH TEMPERATURE ELASTOMERS Annual Summary Report, June 27, 1961-Sept. 30, 1962

K. C. Tsou, S. J. Makower, R. N. Goldey, and B. D. Halpern [1962] 70 p 33 refs
(Contract DA-36-034-ORD-3523-RD)

Progress to date is as follows: 1) The reinforcement of a methyl phenyl silicone elastomer has been investigated with various chemically modified silica fillers. By milling the filler with the silicone elastomer and then determining the weight loss after heating at 480° F, the following increasing order has been found: $Ø_2Si < CH_2=CHSi < ØSi \leq Ø_2Si-$. The improvement from the triphenylsilyl modified filler can be attributed to the bulky steric factor of the triphenylsilyl group in reducing the depolymerization of the silicone. Molecular weight and change in other physical properties are also determined during this investigation. Based on the data available, a mechanism of interaction of the silicone base and the filler at high temperature has been proposed. 2) Ozonization of the vinyl-modified silica filler has been made, and no significant improvements are noted in the silicone rubber. 3) The effects of various chemically modified fillers on the performance of the silica rubber at high temperature are compared. 4) The evaluation of poly-2,6-dimethyl-1,4-phenylene oxide as a thermally stable polymeric diluent in the silicone elastomer has been made. Author

N63-12432 Bureau of Mines. Tuscaloosa Metallurgy Research Center, Ala.

THERMODYNAMIC PROPERTIES OF CESIUM CHLORIDE AND CESIUM IODIDE FROM 0° TO 300° K

Arthur R. Taylor, Jr., T. Estelle Gardner, and D. F. Smith 1963 11 p 3 refs
(BM-RI-6157)

Low-temperature heat capacities of cesium chloride (7° to 300° K) and cesium iodide (13° to 300° K) were measured with an

adiabatic calorimeter. The heat-capacity measurements were analyzed graphically to determine smooth values of heat capacity, entropy, enthalpy function, and free-energy function at 10° K intervals and at 273.15° and 298.15° K. Author

N63-12662 Princeton U. Frick Chemical Lab., N.J.
VISCOELASTIC PROPERTIES OF PRESWOLLEN POLYMER NETWORKS IN THE TRANSITION REGION
M. C. Shen and A. V. Tobolsky [1962] 11 p 15 refs
(Contract Nonr-1858(07))
(ONR-TR-RLT-56)

Viscoelastic properties of preswollen polymethyl methacrylate and polystyrene in the transition region were studied by modulus-temperature measurements. Inflection temperatures and transition region slopes for a series of diluent contents were determined. They were found to be similar to those of plasticized polyvinyl chloride. Author

N63-12664 Aerojet-General Corp. Structural Materials Div., Azusa, Calif.
DEVELOPMENT OF IMPROVED HIGH-STRENGTH PREIMPREGNATED MATERIALS FOR FILAMENT WINDING (Summary) Report, 26 June 1961 through 1 November 1962
Ira Petker, S. Breiant, and M. Segimoto Dec. 1962 32 p
(Contract NOw-61-0642-c(FBM))
(Rept.-2440)

This report summarizes the work on the program for the period ending 1 November 1962. Data is included for six experimental lots of roving, both dry and preimpregnated. Two experimental lots of roving are currently under investigation in the laboratory. Completion of the evaluation of these eight lots of roving will complete the Phase I portion of the investigation. A description is given of the redirected Phase II of the program, which will be devoted entirely to a study of the preimpregnation process. Author

N63-12667 Hughes Aircraft Co., Culver City, Calif.
ROCKET LINER PROGRAM Final Technical Report, Period Covered 1 July 1960 through 1 October 1962
S. B. Eglin and A. L. Landis 117 p 27 refs
(Contract DA-04-495-ORD-3079)
(Rept. -ROC/LIN-FINAL)

Technology has been developed for the preparation of random stannosiloxane polymers and for the processing of these polymers into inorganic rubbers having mechanical properties comparable to those of the commercial silicone rubbers. These new materials showed insulation capability for the rocket liner application not comparable to that of commercial nitrile rubber-phenolic resin blends but superior to that of silicone rubbers. Other metallosiloxane polymers including chelated titanosiloxanes, aluminosiloxanes and arsenosiloxanes were prepared. The titanosiloxanes and aluminosiloxanes could be processed into cured compositions; however, they did not show promise as thermal insulation materials. Author

N63-12705 National Bureau of Standards, Washington, D.C.
STRESS RELAXATION OF FLUOROCARBON ELASTOMERS DURING GAMMA-IRRADIATION
T. Yoshida, R. E. Florin, and L. A. Wall [1962] 6 p 3 refs For presentation before Polymer Div. at 144th Meeting of the American Chem. Soc., Los Angeles, Apr. 1963
(NASA Order R-56)
OTS: $1.10 ph, $0.80 mf

The stress relaxation of Viton A (copolymer of vinylidene fluoride and perfluoropropylene) and Kel-F Elastomer (copolymer of vinylidene fluoride and chlorotrifluoroethylene) was studied during irradiation with the aid of a recording strain-gage apparatus. At a dose rate of 0.3 × 10^6 r/hr, the dose for 50% stress relaxation of the crosslinked network is in the vicinity of 12 × 10^6r in nitrogen and 6 × 10^6r in air; rather similar values obtained for Kel-F Elastomer. These results indicate a rather large component of crosslink rupture in the overall crosslinking observed upon irradiation of these polymers. At higher dose rates, relaxation occurs at relatively lower total doses. Author

N63-12706 National Bureau of Standards, Boulder, Colo.
ELASTOMERIC SEALS AND MATERIALS AT CRYOGENIC TEMPERATURES Summary Report, Nov. 1960 to Nov. 1961
D. H. Weitzel, R. F. Robbins, P. R. Ludtke, Y. Chori, and R. N. Herring
Jan. 1962 79 p 18 refs
(Contract AF 33(616)-61-04)
(NBS-7234)

This research deals with investigations of elastomeric polymers, with particular emphasis on their usefulness as seals at cryogenic temperatures. O-ring seals utilizing various flange configurations have been extensively evaluated at temperatures between 76° and 300° K. A supporting program of property measurements includes thermal expansivities, shear and compression modulus, differential thermal analysis, and the force-temperature effects of prestressed elastomers. Author

N63-12710 Hughes Aircraft Co. Aerospace Group, Culver City, Calif.
DELAYED ACTION, FOAM-IN-PLACE POLYURETHANE FOR USE IN AN AEROSPACE ENVIRONMENT [Final] Report [Feb. 1961 to Jan. 1962]
Seymour Schwartz Apr. 1962 108 p 20 refs
(Contract AF 33(616)-7925)
(ASD-TDR-62-416)

This report details the materials and techniques developed to meet the requirement of a delayed action, foam-in-place polyurethane for use in an aerospace environment. The methods investigated for preparation of the special polyurethane included a number of chemical blocking reactions, molecular sieves and encapsulation techniques, all designed as restraining agents to inhibit the activity of the isocyanate component. The successful method finally developed utilized the principle of solid components to assure low reactivity and good storability. The optimum compound employed a sterically hindered solid diisocyanate, dianisidine diisocyanate, a solid diol, an ethylene oxide adduct of bisphenol A, a solid triol crosslinker, trimethylol propane, and a solid catalyst, dibutyl tin di-2-ethyl hexoate. The resulting powder mixture was found to have storage stability of at least two months when stored at room temperature. The powder could be activated to produce foams of 2 to 5 pounds per cubic foot density on heating to 175° to 250° F in a vacuum environment. By addition of a water liberating blowing agent, boric acid, foams can also be made under ambient pressure conditions. Structural components, made to demonstrate the utility of the powder, consisted of a seven-foot-diameter balloon which, using predistributed powder on its surface, was inflated and rigidized at a simulated altitude of 150,000 feet, and a full-sized man-supporting chair which was also made under the same conditions. In both cases infrared heat was used as the triggering mechanism. Author

N63-12778 Bureau of Mines, Washington, D.C.
HEATS AND FREE ENERGIES OF FORMATION OF BARIUM OXIDE AND STRONTIUM OXIDE
Alla D. Mah 1963 12 p 9 refs
(BM-RI-6171)

Combustion energies of barium and strontium were measured by means of the combustion bomb calorimeter. The heats of formation obtained for the oxides were $\Delta H_{298.15} = -139{,}060 \pm 700$ cal/mole of barium oxide (BaO) and $\Delta H_{298.15} = -144{,}440 \pm 400$ cal/mole of strontium oxide (SrO). Tables containing heats and free energies of formation from 298.15° to 2,000° K were prepared. Author

N63-12779 Bureau of Mines, Washington, D.C.
PRESSURE FORMING OF ALUMINUM OXIDE
Sara Jane Boles and Edwin E. Maust, Jr. 1963 18 p 8 refs
(BM-RI-6174)

The purpose of this investigation was, primarily, to isolate and examine the effect of liquid content upon the apparent porosity and bulk density of compacts pressed from high-purity, fused aluminum oxide, and, secondarily, to study the actual mechanism by which the liquid content affects the bulk density. This study is an intercomparison of the bulk densities obtained as functions of the water contents of the compacting mixtures. Water content was varied from 7 percent to 25 percent, on a total-weight basis. The data gathered indicated a well-defined optimum water content for obtaining minimum apparent porosity and maximum bulk density, under the conditions of the experiment. Author

N63-12781 Bureau of Mines. Berkeley Thermodynamics Lab., Calif.
HEATS AND FREE ENERGIES OF FORMATION OF VANADIUM NITRIDE AND VANADIUM CARBIDE
Alla D. Mah 1963 12 p refs
(BM-RI-6177)

Energies of combustion of vanadium nitride (VN) and vanadium carbide (VC) were measured. Correcting to vanadium tetroxide (V_2O_4) as the final state, the heats of combustion were $\Delta H_{298.15} = -118{,}700 \pm 100$ cal/mole of vanadium nitride and $\Delta H_{298.15} = -240{,}270 \pm 360$ cal/mole of vanadium carbide. With vanadium pentoxide (V_2O_5) as the final state, the heats of combustion were $\Delta H_{298.15} = -133.440 \pm 100$ cal/mole of vanadium nitride and $\Delta H_{298.15} = -255{,}020 \pm 360$ cal/mole of vanadium carbide. Combining these results with vanadium oxide data, the heats of formation obtained were $\Delta H_{298.15} = -51{,}880 \pm 200$ cal/mole of vanadium nitride and $\Delta H_{298.15} = -24{,}350 \pm 400$ cal/mole of vanadium carbide. Heats and free energies of formation of vanadium nitride and carbide were calculated to 2,000° K. Author

N63-12787 Rome Air Development Center, Techniques Lab., Griffiss AFB, N.Y.
LOW FREQUENCY BREAKDOWN IN DIELECTRIC GASES
Vincent C. Vannicola Dec. 1962 22 p 4 refs
(RADC-TDR-62-585)

Experiments were conducted on the breakdown strength of several dielectric gases at 60 cycles per second in the region of a spark plug gap. Breakdown power of sulfurhexafluoride (SF_6) was 20% greater when the electrodes were degassed at 50 microns compared to 1000 microns. As the concentration of SF_6 was decreased from 98% to 50%, only a small decrease in breakdown strength was noted. It is estimated that this factor can be used to reduce leakage of SF_6 by approximately 50%. The degradation effects of prolonged arcing were measured on breakdown onset voltage, extinguish voltage, and chemical decomposition. Gases analyzed, listed in their order of decreasing dielectric strength, include C_4F_8, Freon 115, SF_6 C_2F_6, Freon 116, and air. These experiments are to be continued and extended at microwave frequencies at S-band. Author

20 MATHEMATICS

Includes: calculation methods and theory; computers; data processing; and numerical analysis.

For related information see: 08 Communications; 09 Electronics; 10 Facilities; and 22 Navigation and Guidance.

N63-12381 Wisconsin U., Madison
CONVERGENCE OF RECURRING SERIES WITH GENERAL-ORDER RECURRENCE RELATIONS Technical Summary Report
F. M. Arscott Dec. 1962 27 p 10 refs
(Contract DA-11-022-ORD-2059)
(MRC-349)

The problem considered is that of determining the radius of convergence of the series $\sum_{r}^{\infty} u(r)x^r$, when the coefficients u(r) are connected by a recurrence relation containing (p + 1) terms. Apart from the trivial case p = 1, only the case p = 2 has hitherto been treated, using the method of continued fractions, which cannot be generalized to p > 2. In this paper, a matrix technique is given, which is applicable to any value of p, whereby infinite products of (p × p) matrices are used to formulate characteristic equations and expressions for the u(r). Particular attention is given to the situation in which the problem involves (p − 1) variable parameters, whose values have to be determinded in order to secure the greatest possible radius of convergence. Author

N63-12382 Wisconsin U., Madison
TWO-PARAMETER EIGENVALUE PROBLEMS IN DIFFERENTIAL EQUATIONS Technical Summary Report
Felix M. Arscott Dec. 1962 27 p 7 refs
(Contract DA-11-022-ORD-2059)
(MRC-350)

The problem considered is the following. The parameters λ, μ are to be so chosen that the differential equation

$$\frac{d^2w}{dz^2} + \{\lambda + \mu f(z) + g(z)\} w = 0,$$

should have a nontrivial solution satisfying three boundary conditions of the type w(a) = w(b) = w(c) = 0. Formal properties of solutions (orthogonality, eigenfunction expansions) are established, and some results obtained on the real character of the eigenvalues. Two integral relations are given, leading to a reduction of the original problem to a one-parameter problem involving a nonlinear integral equation. Author

N63-12384 Wisconsin U., Madison
AN ALGORITHM FOR SINGULAR QUADRATIC PROGRAMMING Technical Summary Report
J. C. G. Boot Nov. 1962 25 p 1 ref
(Contract DA-11-022-ORD-2059)
(MRC-353)

The present paper deals with an algorithm for quadratic programing when the matrix of the quadratic part of the maximand is semidefinite. When m is the number of linear inequality constraints, the algorithm leads to a simplex tableau of order m × 2m. An algorithm is given which is valid when the matrix of the quadratic part is strictly definite. Linear programing, which is considered as a quadratic programing problem with a zero matrix for the quadratic part of the maximand, is discussed. Singular quadratic programing is also described. The algorithm solves explicitly for the dual problem as well. Author

N63-12385 Wisconsin U., Madison
SOME RELATIONSHIPS BETWEEN BERS AND BELTRAMI SYSTEMS AND LINEAR ELLIPTIC SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS Technical Summary Report
W. V. Caldwell Dec. 1962 32 p 9 refs
(Contract DA-11-022-ORD-2059)
(MRC-354)

In the study of linear elliptic systems of first order partial differential equations in two independent variables, it has long been recognized that the *Bers* and *Beltrami* systems play a special role. In this paper, a matrix representation of classes of pseudoregular functions which form a real linear vector space is developed and used to further explore this role. In particular, it is shown that if a, b, c, and

d are *Hölder*-continuous real-valued functions defined in a domain D in the complex plane and such that $4bc - (a + d)^2 > 0$ in D and $F = u + iv$ is a solution of the elliptic system L defined by (i) $U_x = aV_x + bV_y$, (ii) $-U_y = cV_x + dV_y$, then F may be represented by the composition mapping $g \cdot h$ where h is a homeomorphic *Beltrami* function and g is a *Bers* function. Conversely, if f is analytic in D, one can find a homeomorphic *Bers* function h and a *Beltrami* function g such that $f = g \cdot h$. Finally, if the coefficients of L are C^1, there exists a system L^* whose solutions are uniquely determined by solutions of L and if f is a solution of L and g is the corresponding solution of L^*, the zeros of g are the critical points of F. Author

N63-12387 Wisconsin U., Madison

SHIFT INVARIANT LINEAR MANIFOLDS Technical Summary Report

P. M. Anselone Dec. 1962 10 p 5 refs
(Contract DA-11-022-ORD-2059)
(MRC-359)

This paper gives a characterization of solution manifolds of ordinary differential equations with constant coefficients as finite-dimensional shift invariant linear manifolds of continuous functions. Author

N63-12388 Wisconsin U., Madison

IDEMPOTENTS IN GROUP ALGEBRAS Technical Summary Report

Walter Rudin Nov. 1962 10 p 3 refs
(Contract DA-11-022-ORD-2059)
(MRC-361)

It is known that the idempotent elements in the complex group algebra of any commutative group have some rather striking properties. The present note exhibits simple examples of idempotents on non-commutative groups which fail to have these properties. Author

N63-12389 Wisconsin U., Madison

CONJUGATE FUNCTIONS IN ORLICZ SPACES Technical Summary Report

Robert Ryan Dec. 1962 14 p 6 refs
(Contract DA-11-022-ORD-2059)
(MRC-367)

The purpose of this report is to show that the mapping of a function on the unit circle into its conjugate is a bounded operation in an Orlicz space if and only if the Orlicz space is reflexive. Author

N63-12390 Wisconsin U., Madison

SOME THEOREMS CONCERNING SLOWLY VARYING FUNCTIONS Technical Summary Report

J. Karamata Nov. 1962 21 p 9 refs
(Contract DA-11-022-ORD-2059)
(MRC-369)

Conditions are given for f(t) and the regularly varying function $\phi(x) = x^\gamma L(x)$, so that the asymptotic relation

$$\int_0^x f(t)\,\phi(xt)dt \sim \phi(x) \int_0^x f(t)\,t^\gamma\,dt$$

holds true as $x \to \infty$, or as $x \to +0$. For a special case, one obtains extensions of some results concerning the asymptotic behavior of the Laplace transform of regularly varying functions. Author

N63-12413 Litton Systems, Inc. Data Systems Div., Waltham, Mass.

INVESTIGATION OF AUTOMATION OF SPEECH PROCESSING FOR VOICE COMMUNICATION Final Report, 15 July 1961-14 October 1962

George S. Sebestyen and David Van Meter [1962] 90 p 11 refs
(Contract AF 19(604)-8828)
(AFCRL-62-946)

This report discusses analytic and experimental procedures applicable to improving the performance of a particular type of speech compression system presently being developed at AFCRL under the direction of C. P. Smith. The system operates on the principle that the number of linguistically distinguishable varieties of instantaneous spectrum patterns in speech is much smaller than the total number used during any utterance. Considerable compression can be achieved by replacing original speech patterns by reference patterns selected from a relatively small library, and transmitting correspondingly short index numbers or descriptors identifying the reference patterns so used. The main problem dealt with in the present study concerns the choice of patterns to be used in the reference library. The minimum number of references needed and their exact specification depend on characteristics of human speech that can be determined only by experiment. Author

N63-12457 Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

NS SAVANNAH UPGRADING ANALOG COMPUTER ANALYSIS

R. M. Rosser AEC Div. of Tech. Information, Nov. 1962 194 p 7 refs
(Contract AT(30-1)-2721)
(BAW-1260) OTS: $2.75

This extensive transient analysis of the NS Savannah powerplant used analog computer technique to determine the control and safety system actions required to prevent plant damage following operating and accident transients. This work amplified previous design studies by considering accidents of greater severity, automatic limiting devices to preclude safety action, and more realistic parameters based on operating experience. Author

N63-12637 David Taylor Model Basin. Applied Mathematics Lab., Washington, D.C.

THERMAL ENERGY TRANSPORT CODE TET

Charles W. Dawson Apr. 1962 6 p 1 ref
(DTMB-1613)

This report describes the thermal energy transport code TET, a 39-group slab-geometry transport code designed for the solution of thermal problems. The programing was done in FORTRAN so that TET can be run on an IBM 704 system or on a Philco TRANSAC. Author

N63-12673 Naples U. Istituto di Fisica Teorica

ASYMPTOTIC CONVERGENCE OF RENORMALIZED PERTURBATIVE EXPANSIONS

E. R. Caianiello [1962] 9 p 6 refs

It is proved that the renormalized perturbative expansions of propagation kernels in configuration space, for finite space-time volume of integration, are asymptotically convergent in the sense of Poincaré, if it is assumed that the kernels themselves are continuous functions of the expansion parameter in a neighborhood of the value of the parameter for which the expansions are made. Author

N63-12713 Du Pont de Nemours (E.I.) and Co. Savannah River Lab., Aiken, S.C.

FORTRAN CODES FOR COMPUTING REACTOR FLUX SHAPES IN ONE DIMENSION

William V. Baxter Nov. 1962 37 p 3 refs
(Contract AT(07-2)-1)
(DP-804) OTS: $0.75

Two FORTRAN codes have been prepared for the IBM 704 computer to obtain one-dimensional solutions of the steady-state neutron-diffusion equation in a cylindrical reactor. Solutions are obtained in either a radial or an axial direction. The axial solution has been used in a rod-positioning code designed to approximate the control-rod setting which will provide an optimal flux shape. A maximum of six

homogeneous regions may be used for the flux solution in either direction. Criticality is achieved by variation of the material buckling in all or in any one of the six regions, or by adjustment of an interface. Author

N63-12736 Naval Ordnance Lab., White Oak, Md.
A GENERALIZED BOUNDARY VALUE PROBLEM FOR $u_{xy} = f(x,y,u,u_x,u_y)$
James Conlan Oct. 17, 1962 22 p 5 refs
(NOLTR-62-177)

This paper proves an existence theorem for the partial differential equation $u_{xy} = f(x,y,u,u_x,u_y)$ with certain linear combinations of u, u_x and u_y given on two noncharacteristic curves. Author

N63-12741 Massachusetts Inst. of Tech., Cambridge
REPRESENTATION SCHEMES FOR INVESTIGATING NON-LINEAR PROCESSES Scientific Report No. 1
Donald B. De Vorkin Dec. 1962 96 p 20 refs
(Contract AF 19(604)-4969)
(AFCRL-62-1137)

The work is concerned with systems of ordinary differential equations. A framework is developed in which a statistical approach to the analysis of the equations is natural. One seeks the correlations of the solution in terms of the correlations of initial conditions and/or forcing functions. General representation schemes are developed for this purpose. It is shown that general schemes can converge for arbitrarily large but finite time. In some special cases, all-time representations are obtained. Author

N63-12745 Stanford U. Applied Mathematics and Statistics Labs., Calif.
A NEW DERIVATIVE OF THE EQUATIONS OF ALREADY-UNIFIED FIELD THEORY
Menahem Schiffer and Ronald Adler Jan. 18, 1963 28 p 3 refs
(Contract Nonr-225(11))
(Tech. Rept. 114)

A new derivation of the equations of the already-unified field theory is obtained from the Einstein-Maxwell system of equations by using classical matrix theory and a special local coordinate system. This derivation is claimed to be considerably simpler than the derivation of Wheeler and Misner, which is obtained from the Einstein-Maxwell system of equations by tensor analysis. B.J.C.

N63-12753 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
LIMIT THEOREMS FOR SUMS OF INDEPENDENT VARIABLES TAKING INTO ACCOUNT LARGE DEVIATIONS. II
Yu. V. Linnik Dec. 14, 1962 22 p 16 refs Transl. from Teoriya Veroyatnostey i yeye Primeneniya (Moscow), v. 6, issue 4, 1961 p 377-391
(FTD-TT-62-1148/1+2+4)

Five limit theorems for sums of independent variables taking into account large deviations are presented and proved. I.v.L.

N63-12814 Computer Associates, Inc., Woburn, Mass.
SUMMARY OF A METHOD FOR THE AUTOMATIC CONSTRUCTION OF SYNTAX DIRECTED COMPILERS Scientific Report No. 2
Stephen Warshall Dec. 1962 53 p 1 ref
(Contract AF 19(628)-419)
(AFCRL-62-955)

A program called the Translator, for compiling new source languages, uses a table driven translation algorithm. The Translator accepts one of a wide class of languages, performs a syntactic analysis upon them, and, lastly, processes the source program through an internally programed table look-up. The description of the generation strategy is itself a language describable in the Backus notation; therefore, a variation of the Translator program (the Bootstrap ISO) creates, by processing macros, a set of prototypes of the control tables. After the entire BNF-GSL message has been processed, an additional set of algorithms converts these prototype tables to final form. A pictorial representation of the syntax of the new language for translation description and a sample program in this language are included. M.P.G.

21 METEOROLOGY

Includes: climatology; weather forecasting; lower atmosphere studies; and oceanography.

For related information see: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N63-12357 Massachusetts Inst. of Tech. Research Lab. of Electronics, Cambridge
A METHOD FOR THE DETERMINATION OF HIGH-ALTITUDE WATER-VAPOR ABUNDANCE FROM GROUND-BASED MICROWAVE OBSERVATIONS
A. H. Barrett and V. K. Chung [1962] 22 p 19 refs Previously processed as a reprint; for abstract see N63-10459 01-12
(NASA Contract NASr-101 and NASA Grant NsG-250-62)
OTS: $2.60 ph, $0.86 mf

The microwave resonance line at 22,235 Mc/s (λ = 1.35 cm) arising from uncondensed H_2O in the terrestrial atmosphere is examined in detail as a means of providing easily obtained data on the physical structure of the atmosphere. It is shown that the line profile is drastically influenced by the vertical distribution of H_2O and that the anomalous abundance of uncondensed H_2O above 15-20 km should be easily detected and monitored by ground-based passive microwave observations. The method, capable of 24-hours-per-day operation, can determine abundance changes on a time scale as short as several seconds, if necessary, and reveal horizontal fine structure with a resolution of 150 m at an altitude of 30 km with a 10-foot parabolic receiving antenna. Other atmospheric constituents that have microwave resonance spectra, for example O_3, are amenable to study by this procedure. Author

N63-12469 California U., Los Angeles
FURTHER STUDIES OF NUMERICAL ERRORS IN THE INTEGRATION OF BAROTROPIC FLOW ON A SPHERICAL GRID Final Report, 1 July 1960-31 December 1962
W. Lawrence Gates and Christopher A. Riegel Dec. 31, 1962 46 p 1 ref
(Contract AF 19(604)-6149); Dynamical Weather Prediction Proj.)
(AFCRL-62-1073)

Using a spherical finite-difference grid system covering the hemisphere, numerical solutions of the nondivergent barotropic vorticity equation have been obtained for periods up to 10 days by relaxation methods. In the case of analytic initial conditions, the solutions are sensitive to abrupt changes of the longitudinal mesh size in the regions of appreciable amplitude of the streamfunction tendency. A doubling of the longitudinal mesh size from 5° to 10° at 45° N produces a progressive tearing or shearing in the streamfunction which is quite noticeable at 10 days. When the grid variation is removed to 70° N, however, the solutions at 10 days are free of this defect, although exhibiting the expected phase lag relative to the analytic solution. When applied to hemispherical barotropic prediction with actual 500 mb data, this spherical grid scheme appears to perform as satisfactorily as do conventional (rectangular) grid formulations. Author

N63-12470 California U., Los Angeles

THE EFFECT OF FINITE DIFFERENCES ON THE GROWTH RATES OF UNSTABLE WAVES IN A SIMPLE BAROCLINIC MODEL Scientific Report No. 7

Christopher A. Riegel Oct. 1, 1962 29 p 3 refs

(Contract AF 19(604)-6149)

(AFCRL-62-1078)

The distortion of the growth rates of unstable baroclinic waves is investigated using implicit finite differences to replace the linearized governing equations of a two-parameter model. A variety of space and time mesh sizes Δx and Δt are used, together with three values of the static stability parameter $\delta\theta/\delta p$. On the whole, for commonly used values of Δx and Δt, and for typical values of $\delta\theta/\delta p$, the introduction of finite differences appears to cause only a slight distortion of the growth rates over the major portion of the unstable spectrum, the long waves being less affected than the short waves. Effects due to Δt are particularly minor. The finite-difference growth rates depend very slightly on the zonal wind U, in contrast to the continuous case where no such dependence is found. Author

N63-12580 Wisconsin U., Madison

STUDIES OF THE THREE-DIMENSIONAL STRUCTURE OF THE PLANETARY BOUNDARY LAYER Final Report

Heinz H. Lettau et al Oct. 1962 232 p 83 refs

(Contract DA-36-039-SC-80282)

This report contains a series of nine individual papers presenting the results of continued investigations of the three-dimensional structure of the planetary boundary layer. Special attention is given to the horizontal variations of the boundary exchanges of masses, momentum, and energy (or heat) which are induced by surface characteristics. Work accomplished during three years under the contract has been devoted to four general subtasks: (1) ground-based instrumentation, (2) airborne instrumentation, (3) micrometeorological measurements, and (4) theoretical work, including data evaluation and analysis. Author

N63-12586 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE ATMOSPHERE AS A PART OF THE SPACE ENVIRONMENT

Richard A. Hord, Wilber B. Huston, and Harold B. Tolefson Washington, NASA, Jan. 1963 100 p 126 refs

(NASA TN D-1387) OTS: $2.25

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1. COMPOSITION, TEMPERATURE, DENSITY, AND PRESSURE OF THE ATMOSPHERE Wilbur B. Huston 3-33 54 refs (See N63-12587 06-21)
2. RADIATION BALANCE OF THE EARTH'S ATMOSPHERE Richard A. Hord p 34-52 29 refs (See N63-12588 06-21)
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N63-12587 National Aeronautics and Space Administration. Langley Research Center, Langley Station Va.

I. COMPOSITION, TEMPERATURE, DENSITY, AND PRESSURE OF THE ATMOSPHERE

Wilber B. Huston *In its* The Atmosphere as a Part of the Space Environment Jan. 1963 p 3-33 54 refs (See N63-12586 06-21) OTS: $2.25

Composition, temperature, density, and pressure measurements of the atmosphere are reviewed as well as variations of these properties with altitude and other parameters. Variations of composition with altitude are dependent upon two processes: (1) convective mixing successfully maintains the general constancy of the proportion of major constituents at low altitudes (homosphere) of 110 ± 10 kilometers; (2) diffusion and dissociation processes produce changes in composition and general lowering of average molecular weight at higher altitudes (heterosphere). At altitudes of 500- to 700-km region, the atmospheric constituents merge with the outward extension of the solar corona (protonosphere). The interdependence of atmospheric temperature, density, and pressure is demonstrated, and measurements of these quantities by rocket soundings and by inference from satellite drag data are included. Charts of data showing the latitudinal, seasonal, diurnal, and solar effects on atmospheric properties are included, as well as an extensive bibliography. M.P.G.

N63-12588 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

II. RADIATION BALANCE OF THE EARTH'S ATMOSPHERE

Richard A. Hord *In its* The Atmosphere as a Part of the Space Environment Jan. 1963 p 34-52 29 refs (See N63-12586 06-21) OTS: $2.25

The processes involved in the radiation balance of the earth's atmosphere are reviewed. Of the total solar electromagnetic radiation incident upon the earth and the bulk of its atmosphere, approximately 35% is returned directly to space by reflection and scattering; the remaining 65% is absorbed. The absorbed energy is distributed through the atmosphere and the earth's surface layers by convection, conduction, radiation, phase changes of water in the lower atmosphere, and ionization processes in the upper atmosphere. These processes result in a large increase in entropy; while the incident radiation is mostly in the visible range of wavelengths, the earth and its atmosphere radiate mostly in the infrared range. Terrestrial radiation is impeded by the greenhouse effect (infrared absorption by minor atmospheric species) which maintains the earth's surface and lower troposphere temperatures at relatively high levels. Although the amount of energy transferred in upper atmospheric processes is less than that involved in the lower atmosphere, the upper atmospheric processes are more directly related to near-earth spaceflight and must be investigated further. M.P.G.

N63-12589 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

III. WINDS AND MOTIONS IN THE ATMOSPHERE

Harold B. Tolefson *In its* The Atmosphere as a Part of the Space Environment Jan. 1963 p 53-96 43 refs (See N63-12586 06-21) OTS: $2.25

The dynamic motions of the atmosphere which are of particular interest to spaceflight and satellite operations are reviewed. The large-scale circulation of the atmosphere, the smaller-sized eddy or turbulent velocities at different altitudes, and the particle movements in the fringes of the outer atmosphere are examined to determine their effects on a satellite system. Additional loads, varying with altitude, may be imposed on a space vehicle by fluctuations of wind velocities and sudden wind reversals at high altitudes. In the ionosphere, tidal influences are considered to be the main driving forces, although large effects are being ascribed to atmospheric heating. At heights above 400 km, the motions probably become primarily hydromagnetic, with the earth's magnetic field exercising a strong control over the fluid motions. M.P.G.

N63-12630 Meteorological Office (Gt. Brit.)

AN EXPERIMENT IN OPERATION NUMERICAL WEATHER PREDICTION Scientific Paper No. 16

E. Knighting, G. A. Corby, and P. R. Rowntree London, HMSO, 1962 31 p 11 refs

(MO-728) Available from HMSO: 3s.

A series of experiments in numerical forecasting of wind and pressure fields have been carried out using a METEOR computer. Programs were written to obtain a six-hour forecast based upon midnight data, followed by a new analysis based on this six-hour forecast and such 0600 GMT data as are available, followed by a 24-hour forecast based on the new analysis. The input data was handled by a combination of manual and automatic techniques, and a three-parameter model atmosphere was used. The METEOR computer was found to be inadequate, both in reliability and storage

capacity, for any extension of the model or the area covered by the forecast. The statistical results and visual examination of the forecast charts both showed that the numerical forecasts were not as successful as those made by more conventional means, but that relatively small improvements in the analysis, the model, and the accuracy of the data handling would be sufficient to reverse this position. M.P.G.

N63-12689 National Severe Storms Project, Kansas City, Mo.

ANALYSIS OF THE SEVERE WEATHER FACTOR IN AUTOMATIC CONTROL OF AIR ROUTE TRAFFIC

W. Boynton Beckwith (United Airlines) Washington, Weather Bureau, Dec. 1962 71 p 23 refs

(Contract Cwb-10110)

(NSSP-12; Previously issued as UAL Meteorological Circular No. 54)

Two severe squall-line cases have been studied, using radar, aircraft, upper air and surface data collected by the National Severe Storms Project. The weather effects of these two cases on the control of air traffic have been analyzed, using logs of taped conversations received in two Air Route Traffic Control Centers. Confirmation of the thunderstorm echo features from a WSR-57 radar are good when checked against photographs and flight logs of research aircraft flying various patterns around the storms. One flight involves a supersonic penetration of a strong buildup. Verification of related forecasts are made from scope data. Most of the important developments fell within the forecasted areas, but the areas designated are too large to be of operational use except for preliminary planning. The short range forecast required in the traffic control computer now envisioned can best be satisfied by sequenced radar echo data measured with a variable gain control. Other methods of acquiring the severe weather measurements for computer input have been evaluated and fall short of the capabilities provided by ground radar. Recommendations have been made which designate the lines along which research should be extended for increasing our knowledge of thunderstorm dynamics and, more specifically, for improving forecasting techniques. Author

N63-12698 Naval Research Lab., Washington, D.C.

THE VERTICAL DISTRIBUTION OF WATER VAPOR OVER HYDERABAD, INDIA, AND COMPARISON WITH MID-LATITUDE DISTRIBUTION

H. J. Mastenbrook Aug. 13, 1962 17 p 6 refs

(NRL-5817)

Three stratospheric soundings over India with a balloon-borne frost-point hygrometer in April 1961 provided data which have been analyzed subjectively to resolve inconsistencies in the data observations. The composite distribution shows a mixing ratio minimum of 0.003 g/kg, a condition of near saturation in a 5000-foot interval which includes the tropopause. Above this level, the mixing ratio increases with altitude and at the 20-millibar level becomes six times greater than the minimum value. The distribution is in substantial agreement with midlatitude observations for April and June of the previous year. The Hyderabad potential temperature vs. mixing ratio distributions for levels above the 100-millibar level is in substantial agreement with midlatitude distributions for April and June of the previous year. At levels between 200 and 100 millibars, the Hyderabad distribution (April) agrees closely with the midlatitude distribution for June; however, the April midlatitude distribution showed substantially lower potential temperatures than the Hyderabad distribution for corresponding values of mixing ratio. This region has been further examined using the large amount of frost-point data collected by the British Meteorological Research Flights over southern England. Monthly mean potential temperature-mixing ratio distributions show a seasonal shift to lower potential temperatures in winter, and daily distributions for spring and fall show a monthly range of potential temperature shift for corresponding values of mixing ratio which is comparable to the annual range of the monthly means. Day-to-day shifts of the potential temperature for the potential temperature-mixing ratio distributions are evidence of mixing ratio gradients along potential temperature surfaces; the comparison of midlatitude distributions with the low-latitude Hyderabad distribution suggests the existence of a latitudinal gradient. Author

N63-12758 Miami U. Marine Lab., Coral Gables, Fla.

EVALUATION AND APPLICATION OF A SPECIAL WEATHER RADAR RECEIVER SYSTEM Final Report, 22 December 1960 to 19 February 1962

H. W. Hiser, P. E. Norman, and C. E. Steen Mar. 1962 74 p 12 refs

(Contract NOw 61-0246-d)

The evaluation of a specially designed radar receiver system for research and operational use in the field of meteorology is discussed. Numerous second- and third-generation modifications and improvements in the SP-1M radar system are described. These include changes in the Range Attenuation Corrector, the Transistorized Video Distribution System, the Iso-Echo Contour System, and the Automatic Frequency Control System, plus the installation of a Ferrite Isolator. Several modernizations and improvements in the model CR-2 radarscope cameras are also presented. Results of a two-year study of precipitation echo heights in the South Florida region are summarized. The effects of range attenuation upon RHI scope measurements of echo tops are evaluated. Minimum detectable rainfall rates and vertical beamwidth stretching of precipitation echo tops are considered in this evaluation. Radar observations, synoptic weather data, and eye-witness accounts of the Miami tornado of 17 June 1959 are presented and discussed. Author

22 NAVIGATION AND GUIDANCE

Includes: autopilots; star tracking; inertial platforms; and traffic control.

For related information see: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities; 15 Instrumentation; 20 Mathematics; and 29 Space Sciences.

N63-12371 Army Missile Command. Guidance and Control Lab., Redstone Arsenal, Ala.

APPLICATION OF ENCODERS IN MISSILE AZIMUTH ALIGNMENT SYSTEMS

F. J. Mooney Dec. 31, 1962 11 p

(RG-TR-62-8)

The use of shaft angle encoders in missile azimuth alignment systems is discussed. A brief résumé of the characteristics of several encoders is presented with a discussion of the use of incremental encoders as a step toward increased system reliability. Author

N63-12488 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PRELIMINARY REPORT ON THE SINGLE STATION DOPPLER-INTERFEROMETER ROCKET TRACKING TECHNIQUE

J. Carl Seddon Washington, NASA, Jan. 1963 33 p 5 refs

(NASA TN D-1344) OTS: $1.00

A portable trailer-housed system is described that provides range timing, range safety, telemetry, and rocket tracking services where normal rocket range facilities may not be available. Various methods of operating the station, with approximate cost estimates, are presented. Author

N63-12539 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, Calif.

THEORETICAL INVESTIGATION OF THE PERFORMANCE OF PROPORTIONAL NAVIGATION GUIDANCE SYSTEMS-EFFECT OF METHOD OF POSITIONING THE RADAR ANTENNA ON THE SPEED OF RESPONSE

Marvin Abramovitz Washington, NACA, Aug. 13, 1952 34 p 5 refs
(NACA RM A52E27) OTS: $3.60 ph, $1.22 mf (Declassified)

The effect of the method of positioning the radar antenna on the maximum obtainable speed of response of three proportional navigation guidance systems is investigated. The systems are studied in combination with a given variable-incidence-wing, supersonic, missile configuration, and the effects of flight speed variation and compensating networks are investigated. The principal conclusion is that a desirable response can be obtained if the antenna is stabilized in space. Author

N63-12592 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A STUDY OF THE EFFECT OF A DEADBAND ABOUT A DESIRED PERIGEE ON THE GUIDANCE OF A SPACE VEHICLE APPROACHING THE EARTH

Jack A. White Washington, NASA, Feb. 1963 23 p 7 refs
(NASA TN D-1607) OTS: $0.75

A study has been made to determine the effect of using a deadband to account for instrumentation inaccuracies on the guidance of a space vehicle to a desired perigee altitude. Corrective impulses were applied when the predicted perigee altitude of the vehicle exceeded a boundary of a deadband assumed to exist about the desired perigee altitude. Author

N63-12786 Arbeits- und Forschungsgemeinschaft Graf Zeppelin, Stuttgart (W. Germany)

KOPPELNAVIGATION. DIE AUTOMATISCHE KOPPELNAVIGATION UND IHRE BEDEUTUNG FÜR DIE MODERNE FLUGNAVIGATION. ELEKTRISCHE BAUELEMENTE FÜR AUTOMATISCHE KOPPELRECHNER [DEAD-RECKONING NAVIGATION. AUTOMATIC DEAD RECKONING AND ITS SIGNIFICANCE FOR MODERN FLIGHT NAVIGATION. ELECTRICAL COMPONENTS FOR AN AUTOMATIC DEAD RECKONING COMPUTER]

K. Ramsayer and E. Wildermuth [1961] 72 p 10 refs [Presented at the 48th Stuttgart Aviation Discussion] 28 Mar. 1961 In German

An automatic dead-reckoning system for aircraft is described in detail. Determination of the flight path is accomplished by a running integration of ground speed from factors of air speed, wind speed, Doppler radar measurements, and measurement and integration of acceleration values. These factors along with compass course, grivation (grid variation), and other compensations are fed into a dead-reckoning computer, and the integrated result is displayed on an indicator which contains a strip navigation chart of the area with superimposed grid for coordinate and course readings. The description of the system is copiously illustrated with block and circuit diagrams of individual portions and the system as a whole. Examples of applications of the system are given, and a record of a discussion between flight personnel and engineers regarding technical questions is included. A.S.

23 PHYSICS, GENERAL

Includes: acoustics; cryogenics; optics; and thermodynamics.

For astrophysics see: 05 Astronomy and Astrophysics.

For related information see: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 24 Physics, Solid-State.

N63-12410 Hanford Atomic Products Operation, Richland, Wash.

ELECTRICAL PROPERTIES OF PLUTONIUM OXIDES

C. E. McNeilly Sept. 1962 17 p 5 refs
(Contract AT(45-1)-1350)
(HW-75120) OTS: $0.50

Preliminary measurements have been made on the electrical resistivity and thermoelectric power of plutonium oxide in the composition range of $PuO_{1.70}$ to $PuO_{2.00}$ from 20° to 1000° C. The normal PuO_{2-x} composition which results from the vacuum sintering of PuO_2 has been shown to exhibit p-type conductivity at room temperature. This changes on heating to n-type which is characteristic of oxygen deficient PuO_{2-x}. Room-temperature resistivity and low-temperature activation energy varies directly with oxygen content. The activation energy for electronic conduction for PuO_{2-x} is 0.52 ev over a wide range of oxygen content, while the intrinsic activation energy for PuO_2 is 1.8 ev. Author

N63-12411 Hanford Atomic Products Operation, Richland, Wash.

PHYSICS RESEARCH QUARTERLY REPORT, JULY, AUGUST, SEPTEMBER, 1962 Preliminary Report

C. W. Lindenmeier et al Oct. 15, 1962 55 p 26 refs
(Contract AT(45-1)-1350)
(HW-75228) OTS: $1.50

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3. THE SCATTERING LAW FOR ROOM TEMPERATURE LIGHT WATER D. A. Kottwitz and B. R. Leonard, Jr. p 11 1 ref Abstract only
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9. CRITICAL MASS EXPERIMENTS WITH PLUTONIUM NITRATE SOLUTIONS R. C. Lloyd, E. D. Clayton, and C. R. Richey p 33-39 5 refs
10. LIMITING CRITICAL CONCENTRATIONS OF U^{235} and Pu^{239} IN AQUEOUS SOLUTIONS J. D. White, T. J. Powell, and R. H. Masterson p 40-53 2 refs

N63-12419 California U., Berkeley. Lawrence Radiation Lab.

ELECTRON-ENERGY DISTRIBUTIONS AND IONIZATION RATES IN HYDROGEN WITH CROSSED ELECTRIC AND STRONG MAGNETIC FIELDS

Gary A. Pearson and Wulf B. Kunkel Sept. 5, 1962 65 p 20 refs
(Contract W-7405-eng-48)
(UCRL-10366) OTS: $1.50

The calculation of the electron velocity distribution in a slightly ionized gas with $(\omega_b\tau)^2 \gg 1$ is discussed, including a detailed treatment of inelastic processes. The derived equations apply whenever the gas density n_g, the gas-flow velocity, $\vec{E}$, and $\vec{B}$ are spacially uniform and constant in time, the component of $\vec{E}$ parallel to $\vec{B}$ is negligible, and E is much less than B (in Gaussian units). The equations are suitable for numerical computation of the electron energy distribution and drift velocity in the reference frame in which $\vec{E}$ is negligible and the gas flow is perpendicular to $\vec{B}$ so that the electron velocity distribution is nearly isotropic. When the rms molecular speed in this frame is much smaller than the rms electron speed, the

equations can be greatly simplified; although the results are not new, this derivation clarifies their physical interpretation and limitations. With simplified equations, the electron-energy distribution, drift velocity, ionization rate, and diffusion tensor in cold stationary H_2 gas are calculated for cE/B between 4×10^4 and 6×10^7 cm/sec. Whereas the electron-energy distribution depends only on cE/B, the other quantities also have simple dependences upon n_g and ω_b. In view of the large uncertainty in important collision cross sections, the agreement with recent experimental results is reasonably good. Author

N63-12420 California U., Berkeley. Lawrence Radiation Lab.
ENERGY EXCHANGE BETWEEN COLD GAS MOLECULES AND A HOT TUNGSTEN SURFACE
Gerald Leroy De Poorter (M. S. Thesis) Nov. 12, 1962 36 p 12 refs
(Contract W-7405-eng-48)
(UCRL-10504) OTS: $0.75

The exchange of energy between a tungsten filament heated at 1710° to 2500° K and cold helium, neon, argon, nitrogen, and carbon dioxide is studied. Gas pressures from 0.1 to 10μ Hg are used. The exchange of energy is directly proportional to the gas pressure but is essentially independent of the filament temperature. The results are interpreted in terms of a process in which the impinging gas molecules are first physically adsorbed, then heated until they gain sufficient thermal energy to overcome the attractive forces of the tungsten surface. On the average, the gas molecules then desorb at a certain critical temperature that is independent of the filament temperature. The critical temperatures for the gases used lie between 350° and 550° K. Author

N63-12422 California U., Berkeley. Lawrence Radiation Lab.
NUCLEAR REACTIONS INDUCED BY PIONS AND PROTONS
Paul L. Reeder (Ph. D. Thesis) Nov. 27, 1962 184 p 99 refs
(Contract W-7405-eng-48)
(UCRL-10531) OTS: $2.75

Pion-nucleon scattering has a unique feature not present in nucleon-nucleon scattering—that is, the large resonance peak at an incident pion energy of 190 Mev. It is this resonance peak that makes it possible to identify πN collisions within nuclear matter. The specific reaction studied here was the $C^{12}(\pi^-,\pi^-n)C^{11}$ reaction. Cross sections were measured as a function of energy through the free-particle resonance region. The existence of a peak in the (π^-,π^-n) excitation function is interpreted as a direct result of a πN collision within the C^{12} nucleus. The greater accuracy obtained in the experiment for the $C^{12}(\pi^-,\pi^-n)C^{11}$ reaction is due to the use of a nonchemical technique for identifying the C^{11} radiation. The C^{12} targets were made of plastic scintillators which, after irradiation with pions, became the detector for the positrons from C^{11}. This technique gave high detection efficiency and 100% chemical yield. Author

N63-12423 California U., Livermore. Lawrence Radiation Lab.
HIGH ENERGY BREMSSTRAHLUNG FROM PROTON-NUCLEUS COLLISIONS
Walter C. Beckham Aug. 15, 1962 101 p 24 refs
(Contract W-7405-eng-48)
(UCRL-7001) OTS: $2.25

Theoretical calculations are described and numerical results given for the production of high energy bremsstrahlung from proton beam bombardment of nuclei. The results are compared with experiment. A best fitting momentum distribution is deduced for the nucleons in beryllium. It has a mean kinetic energy of 32 Mev. The model used assumes proton neutron interactions as a radiation source. Some calculations for a proton-nucleus interaction are given. These do not fit experimental data at all well. Born approximation was used. The parameters in a square well potential with exchange forces and a repulsive core are set up to agree with experimental neutron proton scattering, also calculated by Born approximation. The integration was done on computers. The exclusion principle was taken into account by excluding final states—or permitting them—in accordance with the fraction of phase space occupancy of the assumed momentum distribution. A notable feature is the strong dependence of radiation cross section on the assumed momentum distribution. Author

N63-12454 Hanford Atomic Products Operation, Richland, Wash.
THERMAL CONDUCTIVITY OF UO_2
J. L. Daniel, J. Matolich, Jr., and H. W. Deem (Battelle Memorial Inst.)
Sept. 1962 20 p 26 refs
(Contract AT(45-1)-1350)
(HW-69945) OTS: $1.00

Thermal conductivity has been measured on several types of UO_2 specimens, both irradiated and nonirradiated. Variations in fabrication conditions can result in wide differences in thermal conductivity. High density, nonsintered, crystal compacts have a low, nearly temperature-independent conductivity, while sintered polycrystalline UO_2 exhibits typical decreasing conductivity inversely proportional to temperature. Single crystals of UO_2 display increasing heat-transfer rates at temperatures above 700°C, probably as a result of contributions by radiation and other energy transfer mechanisms. Irradiation of sintered UO_2 at less than 100° C causes a decrease in thermal conductivity to 50% or less of its nonirradiated value near room temperature. As the temperature is raised, conductivity tends toward the corresponding nonirradiated values; pronounced stages of "recovery" occur near 150° C and 400° C, and less definitely near 800° C. This thermal annealing coincides with UO_2 crystal lattice parameter recovery, and appears to be associated with crystal lattice damage sustained during irradiation. Above 1000° C, no significant influence of irradiation on sintered polycrystalline UO_2 has been observed. Author

N63-12459 Princeton-Pennsylvania Accelerator, Princeton, N.J.
THEORY AND METHODS OF MAGNETIC SYSTEMS DESIGN
Jacob Y. M. Wong (B. A. Thesis) AEC Div. of Tech. Information, May 1, 1962 123 p 19 refs
(Contract AT(30-1)-2137) OTS: $2.50
(PPAD-459-F)

The methods of controlling secondary beams with electromagnetic forces are discussed to point out the criteria for designing magnetic systems. The basic components of these systems are described along with a technique for tracing the trajectory of a particle, using matrices. The phase-ellipse method for calculating beam transport properties is used to analyze simple combinations of basic components. Deviations of the magnetic system are discussed, and the methods of selecting the parameters of a magnetic system are outlined. R.C.M.

N63-12472 Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
THE THERMODYNAMIC PROPERTIES OF NITROGEN FROM 64 TO 300°K BETWEEN 0.1 AND 200 ATMOSPHERES
Thomas R. Strobridge Jan. 1962 91 p 20 refs
(NBS-TN-129) OTS: $2.25

The internal energy, enthalpy, entropy, and specific volume of molecular nitrogen are derived and tabulated as functions of temperature and pressure. In addition to a mathematical model for the pressure-volume-temperature surface, accurate functions are given for the representation of the vapor pressure, density of saturated liquid, specific heat of saturated liquid, and the specific heat at zero pressure. Author

N63-12476 Ames Lab., Iowa State U. of Science and Tech.

CATALOG OF NUCLEAR QUADRUPOLE INTERACTIONS AND RESONANCE FREQUENCIES IN SOLIDS. PART I. ELEMENTS AND INORGANIC COMPOUNDS Research and Development Report

S. L. Segel and R. G. Barnes Oct. 1962 68 p 293 refs
(Contract W-7405-eng-82)
(IS-520) OTS: $1.25

This catalog gives the quadrupole resonance frequency for a given nucleus in a given compound and, where reported in the literature, the coupling constant. For those cases where the coupling constant is not given, the equations which enable one to calculate them are provided. In addition, a listing of quadrupole moment ratios is given which permits calculating the coupling constant for a different isotope than the one listed in the catalog. B.J.C.

N63-12494 Aerojet-General Nucleonics, San Ramon, Calif.

ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. HECTIC-II: AN IBM 7090 FORTRAN COMPUTER PROGRAM FOR HEAT TRANSFER ANALYSIS OF GAS OR LIQUID COOLED REACTOR PASSAGES

N. Kattchee and W. C. Reynolds Dec. 1962 79 p 6 refs
(Contract AT(10-1)-880)
(IDO-28595) OTS: $2.00

Hectic-II is an IBM 7090 FORTRAN computer program for calculating pressure drop, flow rates, heat-transfer rates, and temperature in heat exchangers such as fuel elements of typical gas- or liquid-cooled nuclear reactors. The program is extremely flexible and unique in that the effects of turbulent momentum and heat interchange between flow passages are considered. The computation procedure amounts to a "nodal" or "lumped parameter" type of calculation. The axial mesh size is automatically selected to assure that a prescribed accuracy of results is obtained. Author

N63-12565 Comitato Nazionale per l'Energia Nucleare. Lab. Nazionali, Frascati (Italy)

MISURE CON CAMERE DI IONIZZAZIONE IN MATERIALE EQUIVALENTE AL TESSUTO UMANO [MEASUREMENTS IN AN IONIZATION CHAMBER ON MATERIAL EQUIVALENT TO HUMAN SKIN]

M. Ladu, A. Palma, M. Pelleccioni, and E. Rotondi July 13, 1962 11 p 8 refs In Italian
(*Its* Nota Interna 150; LNF-62-60)

The problems of protection from radiation around high-energy accelerators have been studied by several groups. This paper not only contains a study of diffused radiation, but also accounts for the relative energy spectrum around high-energy accelerators and shielding. From the "Health Physics" point of view, it is necessary to measure various components of the radiation field and to interpret them in the realm of biological significance. This is easy to do if only gamma rays or monoenergetic neutrons up to 20 Mev are considered. But for high-energy accelerators, the radiation field is mixed and the energy spectrum is rather complex. The problem is no longer an easy one because of the diverse values assumed in the EBR factors. An ionization chamber lined with a material equivalent to human skin was constructed. The composition by weight of the material used was: 86.5% carbon, 10% hydrogen, and 3.5% nitrogen. Schematics of the chamber and the various conditions for testing are described. Trans. by P.F.E.

N63-12566 Comitato Nazionale per l'Energia Nuclear. Lab. Nazionali, Frascati (Italy)

SOME CALCULATIONS CONCERNING THE MEASUREMENT OF THE POLARIZATION OF μ-MESONS, USING MOLLER-SCATTERING IN THE MAGNETIZED IRON PLATES OF A SPARK CHAMBER

M. Conte and E. Ganssauge July 14, 1962 23 p 7 refs
(*Its* Nota Interna 151; LNF-62-61)

A method for measuring the polarization of μ-mesons is described which enables the detection of low energy μ-mesons while maintaining a high counting rate. A theoretical discussion of the kinematics of the particles is followed by an examination of the possibility of a simple experiment using cosmic rays and Möller-scattering in a spark chamber. Two spark chambers, each containing 9 iron plates of 30 × 30 cm^2 and 1 cm thickness, could be arranged to distinguish between the two different polarization vectors $P\mu^+$ and $P\mu^-$. The solid angle is determined by the scintillation counters which trigger the spark chamber device. The counters are located immediately before the first and behind the second spark chambers within the iron blocks. The muons have to pass 65 cm of iron to be registered. Thus the low momentum end of the spectrum will be about 920 Mev/c. R.C.M.

N63-12567 Comitato Nazionale per l'Energie Nucleare. Lab. Nazionali, Frascati (Italy)

PHOTOPRODUCTION OF MUON PAIRS IN CARBON

A. Alberigi-Quaranta, M. De Pretis, G. Marini, A. Odian, G. Stoppini, and L. Tau July 30, 1962 11 p 9 refs
(*Its* Nota Interna 153; LNF-62-63)

The coincidences between the two muons of the muon pair photoproduced in carbon have been detected at a rate which agrees with that deduced from the Bethe Heitler formula. In this experiment, the 1000 Mev bremsstrahlung beam of the electronsynchroton was collimated into a 2-cm-diameter spot to strike a carbon target 5cm in length. Muons emitted at 10° in the momentum interval from roughly 300 to 400 Mev/c were deflected by a double-focusing spectrometer to traverse one of the three momentum-defining scintillation counters α, β, and γ, and two wedge-shaped copper absorbers. After emerging from the wedges, the approximately monochromatic muons produced a four-fold coincidence in positive and negative scintillators. A master coincidence between the outputs of these scintillators triggered the sweep of a four-trace oscilloscope; the pulse-height distribution of the patterns obtained in this way was used to distinguish the muon coincidences from pions and electrons. M.P.G.

N63-12569 Comitato Nazionale per l'Energia Nucleare. Lab. Nazionali, Frascati (Italy)

TEORIA LINEARE DELLE MACCHINE ACCELERATRICI. PARTE I: EQUAZIONI LINEARI DEL MOTO E COEFFICIENTI DI SMORZAMENTO DELLE OSCILLAZIONI DI BETATRONE NEL CASO DI FOCHEGGIAMENTO DEBOLE [LINEAR THEORY OF AN ACCELERATOR PART I: ACCELERATION MACHINE-MOTION EQUATIONS AND DAMPING COEFFICIENTS FROM BETATRON OSCILLATIONS]

R. Balzano, G. Sacerdoti, and F. Uccelli Aug. 3, 1962 26 p 11 refs In Italian
(*Its* Nota Interna 155; LNF-62-67)

Motions of particles in a circular-type accelerator are analyzed by means of linear theory and Gaussian approximation. The study is based on particles which are subjected to actions and forces in a circular-type accelerator as follows: (1) to the action of a directed magnetic field, (2) to acceleration at R.F. (radio frequency), (3) to energy loss through radiation, (4) to the action of other charged particles which circulate in the ring of the machine, and (5) to the impacts against molecules of the residual gas. Trans. by P.F.E.

N63-12570 Comitato Nazionale per l'Energia Nucleare. Lab. Nazionali, Frascati (Italy)

METHOD FOR PRODUCING AND ANALYSING LINEARLY POLARIZED GAMMA RAY BEAMS

N. Cabibbo, G. Da Prato, G. De Franceschi, and U. Mosco Aug. 4, 1962 10 p 9 refs
(*Its* Nota Interna 156; LNF-62-68)

A new method is proposed for the polarization and analysis of gamma-ray beams by the use of electron pair production in crystals.

Gamma-ray beam cross sections were measured for crystals of copper (face-centered cubic lattice) at 77° K and silicon (diamond lattice) at 300° K. Results showed that the efficiency of the method increased with the photon energy. A device utilizing this method can be used as an analyzer or polarimeter. R.C.M.

N63-12573 Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati (Italy)

SPIN CORRELATION IN MUON PAIR PRODUCTION

F. Erdas and G. V. Gehlen Sept. 7, 1962 19 p 4 refs
(*Its* Nota Interna 159; LNF 62-75)

The correlation of the muon spins in muon pair production by unpolarized photons is calculated in Born approximation. The longitudinal correlation coefficient is found to be sensitive to a cutoff in the muon propagator at 0.1 fermi. Author

N63-12574 Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati (Italy)

DECAY OF TRAPPED-FLUX IN A SUPERCONDUCTING RING SUBJECTED TO AN IRRADIATION OF α PARTICLES FROM A Po^{210} SOURCE

P. De Feo and G. Sacerdoti Sept. 26, 1962 6 p
(*Its* Nota Interna 161; LNF 62-85)

The decay of the trapped flux in a lead superconducting ring was measured before and after being subjected to a bombardment of alpha particles from a polonium^{210} source. The initial trapped flux was nearly 48 Maxwell; this decayed to half value in 14 hours. Preirradiation with alpha particles did not affect these values. M.P.G.

N63-12575 Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati (Italy)

MEASUREMENT OF THE POLARIZATION OF THE FRASCATI 1-GEV ELECTRONSYNCHROTRON γ-RAY BEAM FROM A DIAMOND CRYSTAL RADIATOR

G. Barbiellini, G. Bolgna, G. Diambrini, and G. P. Murtas Oct. 10, 1962 11 p 5 refs
(*Its* Nota Interna 162; LNF 62-87)

Measurements of the polarization of a 1-GeV electronsynchrotron γ-ray beam was made using a diamond crystal radiator. Since the crystal permits only those photon recoil momenta which are coincident with the reciprocal lattice vectors, the process is not symmetrical around the direction of the primary electron, and the entire bremsstrahlung beam has a net polarization with respect to a crystal plane. This polarization was measured by electron-pair scintillation counters, because the electron pairs produced from linearly polarized photons are emitted preferentially in the plane of polarization. The results of these measurements (a 48±7% change in polarization was detected for a change in angle Θ of 1.6 mrad) indicate that the diamond crystal radiator offers a great advantage over the amorphous radiator. M.P.G.

N63-12576 Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati (Italy)

FORM FACTORS OF K_{e3} DECAY AND KAON PRODUCTION BY HIGH ENERGY NEUTRINOS

A. Funii and E. Celeghini Oct. 19, 1962 13 p 16 refs
(*Its* Nota Interna 163; LNF 62/89)

The cross section of the kaon production reaction by high energy neutrinos, $\mu + p \rightarrow p + e^- + K^+$, is computed in the peripheral approximation. Numerical estimates are made with specific form factors derived from the dispersion theory. The cross section depends on such a dynamical model, hence it can serve as a criterion of the model. Author

N63-12579 Arizona U., Tuscon

WINDOWLESS TUBES FOR X-RAY SPECTROSCOPY

Ralph W. G. Wyckoff and Franklin D. Davidson [1962] 6 p Submitted for Publication
(NASA Grant NsG-120)
OTS: $1.10 ph, $0.80 mf

One of the most important factors limiting the X-ray spectroscopy of the lighter elements is the weakness of their fluorescently excited characteristic radiations. A great increase in intensities useful for spectroscopy is shown to be obtained by eliminating the X-ray tube window. Author

N63-12602 Aerojet-General Nucleonics, San Ramon, Calif.

ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. PRELIMINARY SPECTRAL ANALYSIS OF GCRE AND ML-1 REACTOR OPERATION

J. H. Dorsey Dec. 1962 27 p 2 refs
(Contract AT(10-1)-880)
(AGN-TM-399) OTS: $0.50

The analytical methods employed in a preliminary spectral analysis of the operation of the GCRE and ML-1 reactors to determine the presence, or absence, or underlying periodicity are described. The probable errors assigned to the results are discussed. The analysis concludes that no statistically significant periodicities existed in the reactor data within the limits of resolution of the analytical techniques. Author

N63-12610 Stanford Research Inst. Propulsion Sciences Div., Menlo Park, Calif.

THREE-PARTICLE SCATTERING. I. PLANAR CASE

R. C. Whitten 37 p 12 refs Submitted for Publication
(NASA Contract NASr-49(07))
OTS: $3.60 ph, $1.31 mf

A formal theory of three-particle scattering in a plane is developed using integral equations methods. Expressions for the scattering amplitude and cross section of elastic and inelastic collisions are derived. The effects of indistinguishability of the colliding particles are discussed. Author

N63-12651 Arizona U., Tuscon

QUANTITATIVE CALCULATIONS OF EXCITATION OF CHARACTERISTIC X-RAYS BY ELECTRONS IN THICK TARGETS

E. J. Suoninen [1962] 29 p 23 refs Submitted for Publication
(NASA Grant NsG-120-61)
OTS: $2.60 ph, $1.07 mf

After a short critical survey of some previous estimates on the direct and indirect excitation of characteristic X-rays by electrons in solid targets, new formulas are derived for both intensities using Makhov's description of electron penetration and Kramers' formula for the continuous spectrum. Applications to K-radiation from copper, aluminum, and graphite show that the indirect intensity is at all beam voltages at least an order of magnitude smaller than the direct intensity. The ratio of the two is either almost a constant or a decreasing function of the voltage. The total intensity agrees fairly well with Lorenz' and Dolby's measurements in Al and C. The ratio for Cu agrees well with Castaing's and Descamps' result for Zn. Author

N63-12663 Wayne State U., Detroit, Mich.

THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE LIGHT SCATTERING OF COLLOIDAL SPHERES Technical Report No. 3 (49)

Wilfried Heller Nov. 15, 1962 46 p 58 refs
(Contract Nonr-3511(00))

Theoretical and experimental investigations of the light scattering of colloidal spheres encompass: (1) essentials of the theory of scattering by spheres; (2) formulation of the practically important

expressions with emphasis on those derived from the Mie theory; (3) survey of experimental methods including turbidity measurements, light scattering at Mie angle = 90°, scattering ratio, polarization ratio and depolarization, dissymmetry, forward and backward scattering, angular scanning, and spectra. I.v.L.

N63-12671 Virginia U. Research Labs. for the Engineering Sciences, Charlottesville

STATE-OF-THE-ART LITERATURE SURVEY OF METHODS FOR PRODUCTION OF MOLECULAR BEAMS IN THE ENERGY RANGE OF 1-1000 ev.

R. H. Austin and J. E. Christropher Dec. 1962 104 p 328 refs
(SP-620-101-62U)

This literature search was made as an aid to studies of neutral beam reactions with solid surfaces and gases in the energy range 1 ev to 1000 ev. The search included all applicable abstracting and indexing journals, both domestic and foreign, for the period 1950 to 1962, covering books, journal articles, technical reports, and translations. Primary emphasis was placed on production of the molecular beam, with secondary efforts to uncover literature on ion sources, neutralization of beams, preparation of clean target surfaces, and detection of neutral beam scattering. I.v.L.

N63-12695 National Bureau of Standards, Boulder, Colo.

DIELECTRIC CONSTANT OF LIQUID PARAHYDROGEN

R. J. Corruccini Apr. 1962 16 p 18 refs
(NBS-TN-144; PB-161645) OTS: $0.50

It is shown that the available data on the dielectric constant of hydrogen conform to the Clausius-Massotti equation within the probable experimental errors. The published data cover temperatures from the triple point (~14°K) to well above room temperature and a thousandfold range of densities. Using an average value of the specific polarization, tables of the dielectric constant of the liquid have been computed for temperatures from the triple point (13.803°K) to 32°K (58°R) and pressures from saturation to 340 atmospheres. Author

N63-12721 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Mottingham

THE OPTICS AND STRUCTURE OF CATHODE SPUTTERED LAYERS WITH SPECIAL REFERENCE TO REACTION WITH THE RESIDUAL GAS (OPTIK UND STRUKTUR KATHODENZERSTÄUBTER SCHICHTEN UNTER BESONDERER BERUCKSICHTIGUNG DER REAKTION MIT DEM RESTGAS)

L. Hiesinger and H. König Jan. 1963 13 p 24 refs Transl. from Festschr. 100 Jaehr. W. C. Heraeus GmbH, Hanau. 1951 (Frankfurt am Main) 1951 p 376-391
(TIL/T-5202)

Sputtered films of a chemical compound of cathode metal and residual gas can be formed. Special oxygen compounds of different metals have been formed to make reflection films of different qualities. Structure of films of oxides of aluminum, iron, cadmium, titanium, silicon, and thorium has been studied by electron microscopy. Author

N63-12724 Hanford Atomic Products Operation, Richland, Wash.

EXPERIMENTAL OBSERVATIONS OF UPSTREAM BOILING BURNOUT

E. D. Waters, J. K. Anderson, W. L. Thorne, and J. M. Batch Nov. 1962 20 p 5 refs
(Contract AT(45-1)-1350)
(HW-73902 Rev)

Boiling burnout conditions are generally postulated and observed to occur at the outlet end of uniformly heated test sections. However, during experiments with a 12-foot-long x 0.44-inch-ID test section, boiling burnout conditions were sometimes observed to begin at various locations upstream from the test section outlet. Upstream burnout was observed at mass velocities of 5×10^6 lb/hr-sq ft and higher but not at lower mass velocities. In some experiments the heat flux was purposely increased beyond the initial detection of boiling burnout (film boiling), allowing the condition to spread along the test section. Similar results were obtained for both vertical and horizontal positioning with a system pressure of 1500 psig. The experiments show the necessity of installing burnout detectors along the entire length of the test section. The experiments also show the need for a hydrodynamic model of boiling burnout which would allow prediction of upstream burnout conditions. Author

N63-12726 Hanford Atomic Products Operation, Richland, Wash.

SCATTERING LAW FOR ROOM TEMPERATURE LIGHT WATER

D. A. Kottwitz and B. R. Leonard, Jr. Nov. 7, 1962 41 p 14 refs
(Contract AT(45-1)-1350)
(HW-75526) OTS: $1.00

The Hanford triple-axis crystal spectrometer has been used to measure the Egelstaff scattering law for light water at 22° C for neutron wave vector changes up to 14 $Å^{-1}$ and energy transfers in the range 0.05 to 0.25 ev. The values of initial neutron energy were 0.15, 0.20, 0.30, and 0.40 ev, and scattering angles ranged from 4 to 72 degrees. Scattering by a vanadium sample at 77° K served to establish the spectrometer resolution and efficiency functions. The scattering law $S(\alpha, \beta)$ and the generalized frequency distribution $p(\beta)$ derived from it are in substantial agreement in the overlap region with results obtained by Haywood and Thorson at Chalk River. The function $p(\beta)$ has been extended to $\beta \approx 10$ to include the region occupied by the lowest molecular vibration level near $\beta = 8$. In this region the measured $p(\beta)$ has a low sloping plateau, indicating that the vibrational peak has been smeared out by broad instrumental resolution. The normalization integral of the measured $p(\beta)$ is higher than its theoretical value. Author

N63-12735 California U., Berkeley. Electronics Research Lab.

WAVES IN DRIFTING AND ACCELERATING ELECTRON STREAMS IN RADIAL FLOW

W. B. Bridges and C. K. Birdsall June 29, 1962 33 p 14 refs
(Contract AF 49(638)-102)
(IER Ser. 60, Issue 459)

Equations leading to one general solution for waves in drifting and also accelerating electron streams in radial flow are presented. The basic problem was to ascertain how an initial modulation is carried by the stream from one point to another. Models analyzed were: radial planar flow, radial cylindrical flow, and radial spherical flow. The mode with motion along radius r only and with no variations of any variable normal to r was studied. The solutions were for $i_1(r,t)$, $v_1(r,t)$, $\rho_1(r,t)$, and $E_1(r,t)$ for all r and t. Eulerian hydrodynamical equations were used. New variables were introduced. I.v.L.

N63-12743 Nihon U. Coll. of Science and Engineering, Tokyo (Japan)

PHOTOPROTONS EMITTED FROM LIGHT NUCLEI AND NUCLEAR SHELL STRUCTURE

Saburo Fujii [1962] 24 p 12 refs
(NUP-62-2)

At the photon energy of about 50 to 100 Mev the differential cross sections of photoprotons emitted from light nuclei are explained on the direct interaction model. Some feature reflecting clearly nuclear shell structure is pointed out and the relation of it to the information obtained from (p, 2p) is discussed. Author

N63-12769 Bureau of Mines. Morgantown Petroleum Research Lab., W. Va.

ULTRASONIC PHENOMENA AND METHODS OF MEASUREMENT: A BIBLIOGRAPHY

C[harles A.] Komar and J. Pasini III 1963 35 p 261 refs
(BM-IC-8146)

N63-12771 Naples U. Istituto di Fisica Teorica

RENORMALIZATION GROUP AND COMPLETENESS OF FIELD THEORIES. NUCLEON-PION COUPLINGS

E. R. Caianiello and M. Marinaro Aug. 1962 34 p 8 refs
(Contracts DA-91-591-EUC-162 and AF-61(052)-434)

The problem of the mathematical consistency of a field theory defined by a given local Hamiltonian is studied in terms of the propagator (Green's function) formalism. It is necessary for the mathematical consistency of a theory that all the branching equations satisfied by its propagators be covariant under the transformations of its renormalization group. This analysis permits the finding, systematically and explicitly, of all the terms that need be added to the original Hamiltonian if it were not complete to start with, i.e., if covariance could not be secured for the set of branching equations obtained from it alone. This method is illustrated with reference to the study of the standard meson-nucleon couplings. Author

N63-12809 Rochester U. Inst. of Optics, N.Y.

RESEARCH ON FUNDAMENTALS OF GEOMETRICAL OPTICS Final Report

Robert E. Hopkins Oct. 31, 1962 78 p
(Contract AF 49(638)-668)

A series of programs, prepared for an IBM 7070 data-processing machine, are described. These programs include calculations of the following types: lens read in; third- and fifth-order calculations; automatic correction of third- and fifth-order calculations; skew ray tracing modes; radial energy distribution; frequency response; and library routine. A set of programs, called ORDEALS, has been prepared to carry out many of the requirements for automatic lens design: optics programs for the IBM 7070 computer; a general linearization method for automatic lens correction; and theory justifying use of geometric optical frequency response. B.J.C.

N63-12812 Wisconsin U. Theoretical Chemistry Inst., Madison

A STUDY OF ONE AND TWO ELECTRON CENTRAL FORCE PROBLEMS USING THE HYPERVIRIAL THEOREM

Sidney L. Gordon Jan. 10, 1963 22 p 12 refs Submitted for Publication
(NASA Grant NsG-275-62(4180); Contract AF 33(657)-7311)
(WIS-TCI-8, Ser. 3) OTS: $2.60 ph, $0.86 mf

The hypervirial theorem is used to develop expectation value relationships for one- and two-electron central force problems. Ground-state helium trial functions are scaled to identically satisfy a particular family of these relationships. It is shown that this procedure results in improved expectation values for positive powers of the radial coordinate. Author

N63-12818 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio

AN ION SOURCE WHICH GENERATES IONS THROUGH IMPACT IONIZATION OF GAS MOLECULES

N. S. Zinchenko Jan. 15, 1963 5 p Transl. from Russian Patent 140918, June 20, 1960
(FTD-TT-62-758/1+2+4)

An impact ionization ion source is described which eliminates the use of a magnetic field. The ion collector is at negative potential and is located behind the electron collector which also acts as an electrode to draw off the ions through a central aperture. This design permits an intense ion beam to be focused by an electron beam pointed in the same direction without mixing of the two beams. R.C.M.

24 PHYSICS, PLASMA

Includes: fusion; and magnetohydrodynamics.

For related information see: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N63-12618 Advanced Kinetics, Inc., Costa Mesa, Calif.

LABORATORY SIMULATION STUDIES OF OUTER SPACE PHENOMENA Third Quarterly Status Report, Oct. 11, 1962 to Jan. 12, 1963

Ralph W. Waniek [1963] 14 p 1 ref
(NASA Contract NASw-427)
OTS: $1.60 ph, $0.80 mf

CONTENTS:

1. SIMULATION OF A DIPOLE FIELD WITH A SOLENOID C. T. Benson 5 p (See N63-12619 06-24)

N63-12619 Advanced Kinetics, Inc., Costa Mesa, Calif.

SIMULATION OF A DIPOLE FIELD WITH A SOLENOID

Clark T. Benson *In its* Laboratory Simulation Studies of Outer Space Phenomena 5 p (See N63-12618 06-24)

Reduction in the density of the plasma flow and the preparation of the dipole magnet and associated equipment needed for the study of plasma-field interaction were investigated. Variations in the parameters governing plasma formation resulted in a plasma density reduction from the previous value of 10^{14} cm^{-3} to 10^{13} cm^{-3}. Theoretical studies were conducted to determine the field strength in regions outside but close to a conductor boundary for the simulation of the geomagnetic dipole field. Formulas were derived for expressing the magnetic field outside of a solenoid as a dipole field as well as for error terms. I.v.L.

N63-12681 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

MAGNETOHYDRODYNAMIC BOUNDARY LAYERS

A. Sherman Jan. 1963 39 p 8 refs
(Contract AF 49(638)-914)
(R63SD4)

A review of those new phenomena which arise in magnetohydrodynamic boundary layers is presented. The first topic discussed due to its simplicity and relation to boundary-layer flows is the Rayleigh problem. Here it is shown that the introduction of magnetohydrodynamic forces leads to basic changes in the nature of the flow. Next, the basic boundary-layer equations are deduced and the conditions necessary to yield similar solutions deduced. In succeeding sections, incompressible and compressible boundary layers are treated with attention paid to the appropriate external boundary conditions. Finally, boundary-layer phenomena arising when $R_m \to \infty$ are considered in order to illustrate some new phenomena within the framework of boundary-layer theory. Author

N63-12682 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

MAGNETOHYDRODYNAMIC PROPULSION

A. Sherman Jan. 1963 32 p 25 refs
(Contract AF 49(638)-914)
(R63SD5)

The entire area of magnetohydrodynamic propulsion is reviewed. Continuous flow plasma accelerators are discussed, and the current status of theoretical and experimental studies presented. Both the normal crossed field devices and the so-called Hall accelerators are described. It is shown that these devices offer the promise of efficient operation in the 2 to 4000 sec specific impulse range. Next, the pulsed plasma accelerator with electrodes is considered. Experimental results with confined rail type devices are shown to yield high efficiencies for specific impulses greater than 5000 seconds for times of operation on the order of days. Similar results at lower specific impulses are not yet available. Finally, the experimental work on the pulsed electrodeless device is described, and it is shown that as yet relatively low efficiencies have been obtained. Some of the causes of such low efficiencies are discussed. The extension of this concept to the traveling wave machine is also included. Author

N63-12693 Michigan U. Coll. of Engineering, Ann Arbor

STUDY OF A SEEDED PLASMA

Robert Sylvester Buchanan (Ph. D. Thesis) 1961 131 p 50 refs
(Contract AF 33(616)-8126)

The method of increasing the electrical conductivity of a gas (working fluid) by introducing a foreign element (seeding element) into the gas flow and the determination of the properties of the resulting plasma were investigated. The applications of such seeded plasma other than for diagnostic purposes are manyfold and include the general areas of magnetohydrodynamics and energy conversion. Results indicated that: (1) The most favorable seeding element for thermal ionization of a seeded inert carrier is that element with the lowest ionization potential. In the case of air as the working fluid, the metal oxide (and metal hydroxide) molecule never appears to be sufficiently stable to outweigh the effect of an element with a low ionization potential. (2) If seeding is to be accomplished in a combustion zone for diagnostic purposes (i.e., an accurate measurement of electron concentration), sodium should be used as the seeding element because of the relative instability of sodium hydroxide. (3) The collision cross section of the neutral sodium atom does not appear to be sufficiently large to influence the effective frequency. (4) The collision cross section of the singly ionized sodium atom does not appear to influence appreciably the effective collision frequency of the plasma. (5) The seeding of a gas in a test facility appears to be promising as a diagnostic tool for temperature measurement. By measuring the attenuation at two separate frequencies simultaneously, the plasma frequency and collision frequency can be determined. The collision frequency yields the effective collision cross section of the seeded fluid, so that judicious selection of the working fluids could yield experimental measurements of cross sections. Once the values of cross sections have been verified, one microwave attenuation measurement will be sufficient to determine the fluid temperature. I.v.L.

N63-12699 RAND Corp., Santa Monica, Calif.

IONIZED GASES AT LOW DENSITY IN AXIALLY SYMMETRIC MAGNETIC FIELDS

L. R. Henrich Feb. 1963 15 p 6 refs Submitted for Publication
(NASA Contract NASr-21)
(RM-3429-NASA)

The Boltzmann equation is used to derive the expression for the current in ionized gases at low density in an axially symmetric nonuniform field. The gas is assumed to be in a steady state and collisionless. Using this method, the usual expression for the total drift current is obtained without the necessity of using first-order orbit theory. When the integration is made over the whole region of charged particles, the diamagnetic terms clearly will not contribute to the total current. Author

N63-12734 California U., Berkeley. Electronics Research Lab.

PLASMA OSCILLATIONS AND PARTICLE TRAJECTORIES IN A DRIFTING ELECTRON STREAM; PALMER DIAGRAMS

C. K. Birdsall June 29, 1962 49 p 10 refs
(Contract AF 49(638)-102)
(IER Ser. 60, Issue 458)

Electron trajectories are obtained for the Hahn-Ramo space-charge waves. The approach is to use Lagrangian form of hydrodynamic equations of motion and of continuity. This is in contrast with the more common Eulerian jellied-out fluid approach where the particle identity is lost. The model used is developed in some detail. Trajectory plots are given for the faster and slower space-charge waves by themselves and for velocity modulation for the ratios of driving frequency to plasma frequency, ω/ω_p, of 0.5, 1.0, and 2.0. Author

N63-12791 Princeton U. Plasma Physics Lab., N.J.

ABSORPTION OF ELECTROMAGNETIC WAVES IN QUANTUM AND CLASSICAL PLASMAS

Amiram Ron and Narkis Tzoar (Bell Telephone Labs.) Dec. 1962
35 p 10 refs
(Contract AT(30-1)-1238)
(MATT-159)

A systematic study of the absorption of electromagnetic waves in a quantum (classical) plasma is given, for waves whose frequencies are high compared to the collision frequency and whose wavelengths are long compared to the Bohr (Debye) radius. The treatment rests on the introduction of the temperature-dependent Green's function and Kubo's formula for the conductivity. An exact expression for the conductivity is obtained for a quantum plasma. The special case is treated of a quantum system of electrons in the presence of fixed ion scatterers. Author

N63-12792 Princeton U. Plasma Physics Lab., N.J.

HIGH FREQUENCY CONDUCTIVITY OF QUANTUM PLASMA IN A MAGNETIC FIELD

Carl Oberman and Amiram Ron Jan. 1963 15 p 12 refs
(Contract AT(30-1)-1238)
(MATT-163)

The problem of the electromagnetic absorption coefficient in a quantum plasma in the presence of a uniform magnetic field is investigated by a kinetic description. The finite duration of encounters is taken into account in a self-consistent fashion which includes collective effects properly. This treatment is the quantum extension of an earlier classical study. The application of this theory to heavily doped semiconductors is suggested. Author

N63-12793 Princeton U. Plasma Physics Lab., N.J.

PHENOMENA IN RUNAWAY DOMINATED STELLARATOR DISCHARGES

W. Stodiek and D. J. Grove Dec. 1962 13 p 2 refs
(Contract AT(30-1)-1238)
(MATT-164)

With appropriate programing of the ohmic heating current, hydrogen discharges have been produced in the C stellarator in which (after a short time) all the current is carried by a few runaway electrons in a cold main plasma. All or part of these fast electrons can be lost abruptly, reducing the current in sudden steps. There appear to be two distinct types of such fast loss processes, one involving a

braking of the fast electrons by the electrons of the main plasma, the other showing a somewhat slower loss of electrons to the walls due to lack of confinement. Author

N63-12800 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

THE THEORY OF MAGNETOHYDRODYNAMIC POWER GENERATORS

G. W. Sutton Dec. 1962 202 p 51 refs Submitted for Publication

(Contract AF 49(638)-914)

(R62SD990)

Topics covered are: electrical conductivity in MHD generators, optimum "seed" ratio, local analyses of the continuous and segmented electrode geometries; Hall geometry, helical flow geometry; magnetically induced ionization; polytropic efficiencies; compressible analyses of the constant velocity, temperature, Mach number, pressure and cross-sectional area flows; end losses; AC generation; cycle efficiencies; and a summary of generating experiments. Author

N63-12803 Princeton U. Plasma Physics Lab., N.J.

ASYMPTOTIC THEORY OF SPHERICAL ELECTROSTATIC PROBES IN A SLIGHTLY IONIZED, COLLISION DOMINATED GAS

Ira M. Cohen Nov. 1962 39 p 10 refs

(Contract AT(30-1)-1238)

(MATT-153)

A treatment is given of the problem of an electrostatic probe in a dense, slightly ionized gas by techniques of asymptotic analysis. In particular, the asymptotic limits $\rho_p = r_p/\lambda_d \to \infty$ and $\tau = T_-/T_+ \to \infty$ are treated in considerable detail. (r_p, λ_d, T_-, T_+ are probe radius, Debye length, electron, and ion temperature, respectively.) Sample integral curves for electrostatic potential, ion and electron density are given. Probe characteristic curves for many values of τ (finite and large) and ρ_p (large) are also given. It is noted that these characteristics do not saturate for large probe potential because the influence of the probe is felt to very great distances from the probe; the shielding due to the space sheath is incomplete. Author

25 PHYSICS, SOLID-STATE

Includes: semiconductor theory; and masers.

For related information see: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N63-12571 Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati (Italy)

ABSORPTION OF GAMMA RAYS IN CRYSTALS AND THE PRODUCTION AND ANALYSIS OF LINEARLY POLARIZED GAMMA RAYS

N. Cabibbo, G. Da Prato, G. De Franceschi, and U. Mosco Sept. 3, 1962 34 p 13 refs

(*Its* Nota Interna 157; LNF 62-70)

The coherence effects on the total pair production cross section in crystals at high energy are studied. These effects are dependent on the photon polarization and can be used for the production and the analysis of linearly polarized gamma-ray beams. Author

N63-12613 Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati (Italy)

CIRCULAR POLARIZATION OF HIGH ENERGY γ-RAYS BY BIREFRINGENCE IN CRYSTALS

N. Cabibbo, G. Da Prato, G. De Franceschi, and U. Mosco Sept. 20, 1962 9 p 2 refs

(*Its* Nota Interna 160; LNF-62-84)

A study was made of the feasibility of converting linearly polarized gamma-ray beams into circularly polarized gamma-ray beams by using birefringent single crystals. Calculations are presented which indicate that a crystal of the appropriate thickness can be used as the high-energy analog of a quarter-wavelength plate to convert linear into circular polarization, and vice versa. The conversion efficiency was found to increase with the gamma beam energy. This study suggests the possibility of using a new group of optical instruments for handling very high energy photon beams. M.P.G.

N63-12643 Brown U., Providence, R.I.

INVESTIGATIONS OF SURFACE PROPERTIES OF SILICON AND OTHER SEMICONDUCTORS Final Report, 1 Oct. 1959-30 Sept. 1962

H. E. Farnsworth, J. A. Dillon, Jr., et al Nov. 1962 128 p refs

(Contract AF 19(604)-5986)

(AFCRL-62-949)

CONTENTS:

PHASE I

Part 1. ADSORPTION AND BONDING PROPERTIES OF CLEAVAGE SURFACES OF BISMUTH TELLURIDE D. Haneman (Brown U.) Repr. from Phys. Rev., v. 119, no. 2, July 15, 1960 p 567-569 8 refs

Part 2. COMPARISON OF STRUCTURES OF SURFACES PREPARED IN HIGH VACUUM BY CLEAVING AND BY ION BOMBARDMENT AND ANNEALING D. Haneman (Brown U.) Repr. from Phys. Rev., v. 119, no. 2, July 15, 1960 p 563-566 7 refs

Part 3. SURFACE STRUCTURES AND PROPERTIES OF DIAMOND-STRUCTURE SEMICONDUCTORS D. Haneman (Brown U.) Repr. from Phys. Rev., v. 121, no. 4, Feb. 15, 1961 p 1093-1100 9 refs

Part 4. EFFECT OF A CONSTANT ELECTRICAL FIELD ON GERMANIUM FAST SURFACE STATES Y. Margoninski (Brown U.) Repr. from Phys. Rev., v. 121, no. 5, Mar. 1, 1961 p 1282-1285 9 refs

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Part 6. LOW-ENERGY ELECTRON DIFFRACTION FROM A CLEAVED GERMANIUM SURFACE H. E. Farnsworth (Brown U.) 17 p 3 refs Presented at the N. Y. Acad. of Sci., Apr. 5-7, 1962 Submitted for publication

Part 7. A POST-DIFFRACTION ACCELERATION APPARATUS FOR LOW-ENERGY ELECTRON DIFFRACTION H. E. Farnsworth and Ronald Lee 9 p 10 refs

PHASE II

Part 1. ION-BOMBARDMENT ETCHING OF SILICON AND GERMANIUM J. A. Dillon, Jr., and R. M. Oman (Brown U.) Repr. from J. Appl. Phys., v. 31, no. 1, Jan. 1960 p 26-28 9 refs

Part 2. THE OXIDATION OF SILICON CARBIDE—THE INTERACTION OF OXYGEN WITH SILICON CARBIDE SURFACES J. A. Dillon, Jr. (Brown U.) Repr. from Silicon Carbide, 1960 p 235-240 13 refs

Part 3. SURFACE DIFFUSION EFFECTS AND ION BOMBARDMENT CLEANING OF SILICON AND GERMANIUM J. A. Dillon, Jr., and R. M. Oman (Brown U.) Repr. from the Proc. of the Intern. Conf. on Semiconductor Phys., Prague, 1960 p 533-536 6 refs

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Part 4. PURIFICATION METHODS IN THE STUDY OF SEMICONDUCTOR SURFACES J. A. Dillon, Jr. (Brown U.) Repr. from Ultrapurification of Semiconductor Materials, 1962 p 604-613 25 refs

Part 5. THE CLEAN SURFACE APPROACH TO ADSORPTION STUDIES J. A. Dillon, Jr. (Brown U.) Repr. from 1961 Trans. of the 8th Vacuum Symp. and 2nd Intern. Congr., 1962 p 113-118 40 refs

Part 6. ASYMMETRIES IN THE SURFACE PROPERTIES OF THE (111) and ($\bar{1}\bar{1}\bar{1}$) FACES OF ZINC TELLURIDE J. A. Dillon, Jr. (Brown U.) Repr. from J. Appl. Phys., v. 33, no. 2, Feb. 1962 p 669-672 13 refs

Part 7. SURFACE PROPERTY ASYMMETRIES IN COMPOUND SEMICONDUCTORS J. A. Dillon, Jr., and R. M. Oman (Brown U.) 14 p 19 refs Submitted for publication

Part 8. THE NATURE OF A CLEAN SURFACE J. A. Dillon, Jr. (Brown U.) 21 p 19 refs Presented at the N. Y. Acad. of Sci., Apr. 5-7, 1962 Submitted for publication

N63-12670 Tyco Labs., Inc., Waltham, Mass.

THE TRAVELLING SOLVENT METHOD OF CRYSTAL GROWTH Quarterly Report No. 6, Covering Period August 16 through November 15, 1962

L. B. Griffiths, M. A. Wright, and A. I. Mlavsky Dec. 15, 1962 16 p
(Contract AF 19(604)-8803)
(AFCRL-62-971)

Large crystals of α-SiC have been grown from solution in chromium by the Travelling Solvent Method at an average temperature of ca. 1800° C. The major problem has been the proper wetting of the SiC surface by chromium; this problem has now been solved using an ultrahigh vacuum heating treatment, followed by the evaporation of chromium onto the clean surfaces. Preliminary experiments using silicon and platinum as solvents have shown encouraging results. Author

N63-12675 Brown U. Barus Research Lab. of Physics, Providence, R.I.

THE CLEAN SURFACE APPROACH TO ADSORPTION STUDIES

J. A. Dillon, Jr. [1962] 14 p 40 refs Presented at the American Vacuum Society 8th National Vacuum Symposium
(Supported by the Air Force)

Because of the intimate relationship between adsorption properties and the surface condition of a solid, considerable research has been devoted to the preparation of single crystal surfaces which are initially atomically clean. Several high-vacuum techniques which have been used for this purpose and several methods which have been employed to evaluate the degree of surface cleanliness and perfection are discussed and compared. Examples of the types of information provided by such experiments are drawn from the extensive measurements which have been made of the properties of semiconductor crystal surfaces. Author

N63-12746 California U., Berkeley, Electronics Research Lab.

THREE-LEVEL MASER MATERIALS: A SURVEY OF POTENTIAL MATERIALS, I

J. Wakabayashi Mar. 7, 1962 82 p 80 refs
(Contract AF 49(638)-102)
(IER Ser. 60, Issue 439)

A review is given of paramagnetic resonance in crystals, the relationship between the material parameters and maser performance, and potential crystals for three-level masers. B.J.C.

N63-12827 California U., Riverside

BEHAVIOR OF SOLIDS UNDER PRESSURE Annual Progress Report

A. W. Lawson et al Jan. 1963 6 p 85 refs
(Contracts Nonr-1842(05) and AT/11-1/34 P77)

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1. DEFECT STRUCTURES AND TRANSPORT OF MATTER IN AgBr A. W. Lawson Repr. from J. Appl. Phys. Supplement, v. 33, no. 1, Jan. 1963 p 466-473
2. X-RAY DIFFRACTION STUDIES IN THE 100 KILOBAR PRESSURE RANGE John C. Jamieson and A. W. Lawson Repr. from J. Appl. Phys. v. 33, no. 3, Mar. 1962 p 776-780
3. CYLINDRICAL APPROXIMATION AND THE α-β QUARTZ TRANSITION A. J. Hughes and A. W. Lawson Repr. from J. Chem. Phys. v. 36, no. 8, Apr. 15, 1962 p 2098-2100
4. ON POSSIBLE LOW-PRESSURE POLYMORPHISM IN LiH Raoul Weil and A. W. Lawson Repr. from J. Chem. Phys. v. 37, no. 11, Dec. 1, 1962 p 2730-2731

26 PROPELLANTS AND COMBUSTION

Includes: fuels; igniters; and oxidizers.

For related information see: 07 Chemistry; and 27 Propulsion.

N63-12402 Tokyo U. Aeronautical Research Inst. (Japan)

SOME STUDIES ON SOLID PROPELLANTS. PART III. ANALYTICAL RESULTS OF THE COMBUSTION GASES

Kenji Kuratani Sept. 1962 17 p 18 refs
(*Its* Rept. 374 (Vol. 28, No. 6))

The variations of the composition of combustion gases of ammonium perchlorate (AP) with the addition of various catalysts are studied in hopes of finding good correlation to the burning rate of AP propellant. The effects of the catalysts on the composition of gaseous products of AP combustion are remarkable, and it is concluded that catalysts which produce higher concentration of oxygen and lower concentration of nitric oxide during the combustion of AP may increase the burning rate of propellant. At the same time, some catalysts are very effective in decreasing the mean molecular weight of combustion products of AP. Similar analyses of the combustion products of AP composite propellants are also carried out, but the effect of these catalysts is negligible, and little variation of gaseous composition by the addition of these catalysts is observed. Accordingly, the catalytic effect on the decrease of mean molecular weight of the combustion products of propellants is not remarkable. Theoretical calculations of specific impulse are presented as a reference to the experimental studies. Author

N63-12464 France. Office National d'Études et de Recherches Aéronautiques, Chatillon-sous-Bagneux

FUSÉES À PROPERGOL SOLIDE UTILISANT DEUX POUDRES AYANT DES VITESSES DE COMBUSTION DIFFÉRENTES (SOLID ROCKETS USING TWO COMPOSITE GRAINS OF DIFFERENT BURNING RATES)

Marcel Barrère and Pierre Larue [1962] 11 p 2 refs In French; English summary

The difficulties found in obtaining a neutral solid grain and the losses at the end of combustion may be lessened by using in the same

grain two propellants of different burning rates. The various parameters involved in such a solution have been given in recent papers. In this study, complementary information is given and also some of the results obtained at O.N.E.R.A. emphasizing the possibilities of such a concept. Author

N63-12486 France. Office National d'Études et de Recherches Aéronautiques, Chatillon-sous-Bagneux
[1] VISUALISATION DE LA COMBUSTION D'UN PROPERGOL SOLIDE À L'INTÉRIEUR D'UN PROPULSEUR (VISUALIZATION OF THE COMBUSTION OF A SOLID GRAIN INSIDE A ROCKET MOTOR) Pierre Larue [1962] 9 p 6 refs In French; English summary [2] CHROMATOGRAPHIE EN PHASE GAZEUSE ET SPECTROMÉTRIE INFRAROUGE (GASEOUS PHASE CHROMATOGRAPHY AND INFRA-RED SPECTROMETRY) Colette Bélinski [1962] 2 p In French

This paper deals with an apparatus that is used to visualize the combustion at the front face of a solid grain. Some possibilities of the method are exposed: observation of combustion peculiarities, determination of the combustion velocity in each location of the perforation, determination of the emission velocity of the gases or particles, and contribution to the study of instabilities. It also describes a device, still in the design stage, that allows the simultaneous visualization at both ends of the grain, thus providing the means to determine the erosion function. Measurements combined with visual observation permit checking the results obtained by this method and show the value of other parameters that have an effect on the behavior of a solid rocket. Author

N63-12492 Aerojet-General Corp. Ordnance Div., Downey, Calif.
EXPLOSIVE FORMING OF CLOSURES FOR LARGE SOLID PROPELLANT MOTOR CASES Quarterly Progress Report No. 3, Oct. 17, 1962-Jan. 17, 1963
A. W. Hall and I. Lieberman Jan. 28, 1963 53 p
(Contract AF 04(611)-8395)
(QP-0665-01(03))

Explosively formed 120-inch-diameter heads with 37-inch and 48-inch deflection are described. Comparisons of results from free forming and ice-die forming are made and the relative advantages of each are presented. Specific problem areas associated with material procurement and material handling because of the unique sizes involved are briefly described. Author

N63-12509 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio
EFFECT OF COMBUSTION GAS PROPERTIES ON TURBOJET-ENGINE PERFORMANCE WITH HYDROGEN AS FUEL
Robert E. English Washington, NACA, Apr. 10, 1956 12 p 7 refs
(NACA RM E55J17a) OTS: $1.60 ph, $0.80 mf (Declassified)

Simple adjustment of turbojet engine cycle calculations based on JP-4 fuel for the increase in heating value when hydrogen is substituted for JP-4 resulted in the following errors: Fuel specific impulse was as much as 3 percent high; thrust per unit airflow was as much as 5 percent low; and airflow per unit of turbine frontal area was as much as 1 percent low. Author

N63-12511 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio
A STUDY OF INJECTION PROCESSES FOR 15-PERCENT FLUORINE-85-PERCENT OXYGEN AND HEPTANE IN A 200-POUND-THRUST ROCKET ENGINE
M. F. Heidmann Washington, NACA, Jan. 15, 1957 25 p 4 refs
(NACA RM E56J11) OTS: $2.60 ph, $0.95 mf (Declassified)

Characteristic exhaust velocity over a range of mixture ratios and variations in gas velocity with distance from the injector were measured for six injectors. Comparisons of injector performance showed the gains obtained from oxidant atomization, fuel atomization, and propellant mixing. The results are compared with oxygen and heptane performance and show the effect, which is qualitatively small, of spontaneous propellant ignition on the relation between injection processes and engine performance. Author

N63-12535 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio
AIRCRAFT-FUEL-TANK DESIGN FOR LIQUID HYDROGEN
T. W. Reynolds Washington, NACA, Aug. 9, 1955 28 p 26 refs
(NACA RM E55F22) OTS: $2.60 ph, $1.04 mf (Declassified)

Some of the considerations involved in the design of aircraft fuel tanks for liquid hydrogen are discussed. Several of the physical properties of metals and thermal insulators in the temperature range from ambient to liquid-hydrogen temperatures are assembled. Calculations based on these properties indicate that it is possible to build a large-size liquid-hydrogen fuel tank which (1) will weigh less than 15 percent of the fuel weight, (2) will have a hydrogen vaporization rate less than 30 percent of the cruise fuel-flow rate, and (3) can be held in a standby condition and readied for flight in a short time. Author

N63-12541 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio
LIQUID HYDROGEN AS A JET FUEL FOR HIGH-ALTITUDE AIRCRAFT
Abe Silverstein and Eldon W. Hall Washington, NACA, Apr. 15, 1955 57 p 6 refs
(NACA RM E55C28a) OTS: $5.60 ph, $1.91 mf (Declassified)

The performance of hydrogen as a jet fuel was investigated for the following missions: subsonic bomber, subsonic reconnaissance, supersonic bomber, supersonic reconnaissance, and supersonic fighter. Comparisons are made in some cases with configurations suitably designed for the use of JP-4 fuel. The analysis showed that aircraft designed for liquid-hydrogen fuel with ramjet and/or turbojet engines may perform several imporant military missions that comparable aircraft using conventional hydrocarbon fuel cannot accomplish. M.P.G.

N63-12542 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio
PERFORMANCE OF PENTABORANE, PENTABORANE–JP-4 FUEL MIXTURES, AND TRIMETHYLBORATE AZEOTROPE FUEL IN A FULL-SCALE TURBOJET ENGINE
Roland Breitwieser and James W. Useller Washington, NACA, Nov. 20, 1956 83 p 21 refs
(NACA RM E56G19) OTS: $8.10 ph, $2.69 mf (Declassified)

This report summarizes the full-scale engine tests of pentaborane, pentaborane – JP-4 fuel mixtures, and trimethylborate azeotrope fuel. The tests were conducted in a full-scale turbojet engine at a simulated altitude of 50,000 feet and Mach number of 0.8. Engine speeds were 90 to 100 percent of rated speed. Pentaborane reduced the specific fuel consumption to two-thirds that of JP-4 fuel. However, because boron oxide collected in the engine, the performance deteriorated with continued operation of pentaborane in each of the short-duration tests reported. Thermodynamic data for pentaborane, pentaborane – JP-4 fuel mixtures, and trimethylborate azeotrope fuel are given. Author

N63-12543 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio
FLIGHT INVESTIGATION OF PENTABORANE FUEL IN 9.75–INCH-DIAMETER RAM-JET ENGINE WITH DOWNSTREAM FUEL INJECTION
John H. Disher and Merle L. Jones Washington, NACA, Apr. 22, 1957 29 p 7 refs
(NACA RM E55G01) OTS: $2.60 ph, $1.07 mf (Declassified)

The third flight test of pentaborane fuel in 9.75-inch-diameter ramjet engine was made. The engine incorporated changes made as a result of findings from the first two flights. The third flight was completely successful, with maximum Mach number of 2.06 and maximum acceleration of 7.2 g's attained. Author

N63-12605 Picatinny Arsenal. Ammunition Group, Dover, N. J.
EVALUATION OF THE EFFECTS OF AGING ON M17 PROPELLANT
Louis Wiesenfeld and Marvin Goldstein July 1962 37 p
(PA-TR-3019)

Samples stored at ambient temperatures after manufacture were tested for relative force and quickness at monthly intervals over a one-year period. There was a progressive increase in relative quickness during the test period, with no indication of a leveling off. It is suggested that preconditioning of the propellant might be adopted in order to achieve leveling off in a shorter time. Author

N63-12669 National Bureau of Standards, Boulder, Colo.
RECENT PROGRESS IN CRYOGENIC ENGINEERING
R. B. Scott [1962] 4 p Presented at the Mountain States Navy Research and Development Clinic, Raton, N. Mex., Sept. 28-29, 1961
(NBS-R-213)

Recent progress in cryogenic engineering include: the use of liquid hydrogen in rockets, the liquid hydrogen bubble chamber for the detection and analysis of the elementary particles produced by giant accelerators, the effects of neutron bombardment of solids, the design of a neutron moderator and associated refrigeration equipment, and the proposal of cooled electromagnets for confining plasmas of charged particles at temperatures of the order of 100 million degrees. These plasmas would be involved in obtaining useful power by causing deuterium and tritium to react by fusion. Maser noise is decreased by a factor of 100 by operating at the temperature of liquid helium instead of room temperature. The sensitivity of the infrared detector can be improved and its range extended to longer wavelengths by operation at liquid helium temperature. I.v.L.

N63-12680 Naval Ordnance Test Station, China Lake, Calif.
FLASHDOWN IN SOLID PROPELLANTS [SEPTEMBER 1960 to SEPTEMBER 1962]
Jack. L. Prentice Dec. 1962 41 p 24 refs
(NOTS-TP-3009; NAVWEPS-7964)

The term "flashdown" refers to the phenomenon of runaway burning rate resulting from ignition propagating through such propellant-grain defects as ducts, fissures, annuli, etc. The significant gas dynamic and chemical parameters are evaluated by a study of several strand geometries and propellant formulations. Flashdown temperature profiles are measured by the use of fine-wire platinum thermocouples, and surface ignition velocities are measured from high-speed color motion pictures. Precise correlation of all records was achieved by the use of 100-PPS Binary-Coded Timing (BCT) equipment. A mechanism involving heat transfer to the wall from hot gases moving through the propellant-grain defect is proposed to account for initiation and propagation of the flashdown. Author

N63-12687 Batelle Memorial Inst., Columbus, Ohio
HIGH-TEMPERATURE IRRADIATION TEST OF UO_2 CERMET FUELS
Donald L. Keller, George W. Cunningham, William E. Murr, Earle O. Fromm, and Donald E. Lozier Jan. 7, 1963 24 p 1 ref
(Contract W-7405-eng-92)
(BMI-1608) OTS: $0.50

Niobium-clad niobium cermets and Type 430 stainless steel-clad molybdenum and chromium cermets, all containing 80 volume percent 20 percent enriched UO_2, prepared by vapor-deposition techniques or from the powders and densified and clad by gas-pressure bonding, were subjected to high-temperature high-heat-flux irradiation in the MTR. Two instrumented double-walled capsules, each containing duplicate NaK-immersed cylindrical specimens of the three compositions, were involved. Specimen diameters were varied according to the particular cermet thermal conductivity in an attempt to secure central temperatures of about 0.6 of the matrix melting point. Probably because of weld failures in both capsules, irradiation temperatures were higher than intended, causing loss of the chromium cermets in one capsule and all of the cermets in the other capsule. The remaining specimens were given a postirradiation dimensional and metallographic examination. The niobium-clad niobium-UO_2 cermet exhibited excellent stability at estimated center-line temperatures above 2500° F. A density decrease of only 1.4 percent was measured at a burnup of about 4 a/o. Although the capsule overheating caused the molybdenum-UO_2 cermet to partially melt, areas only a few mils from the melted zone showed no evidence of damage from the adverse conditions of the irradiation. Author

N63-12690 Los Alamos Scientific Lab., N. Mex.
REACTOR IRRADIATION OF URANIUM-IMPREGNATED GRAPHITE AT 1500° C TO 10% BURNUP
P. J. Peterson, J. A. Leary, and W. J. Maraman Jan. 28, 1963 43 p 17 refs
(Contract W-7405-eng-36)
(LAMS-2814) OTS: $1.00

Two type-AUC graphite fuel elements loaded by solution impregnation to an average concentration of 0.115 g/cc of 93.13% enriched U that is converted to UC and UC_2 were irradiated at temperatures about 1500° C to a 10.2% maximum burnup, corresponding to an irradiation level of 219 KWH/cc or 2.45×10^{19} fissions/cc of fuel element. Postirradiation measurements of the elements showed dimensional changes of –4.3 and –4.8% with the grain, and –0.8 to –2.5% across the grain. Weight losses were 3.2 and 5.1% for the individual elements with approximately 11% of the total U^{235} being lost from the elements. With-the-grain thermal conductivity at nominal room temperature was reduced by a factor of ~7 and electrical conductivities by factors of 3.4 to 6.3, also at room temperature. Impact strength appeared to be somewhat improved by irradiation. Uranium migration within the element was detected by radiographic density observations but not evaluated quantitatively. As anticipated, fission product release was high. Author

N63-12832 Aeronutronic, Newport Beach, Calif.
CHEMICAL CORROSION OF ROCKET LINER MATERIALS AND PROPELLANT PERFORMANCE STUDIES. VOL. II. DETAILED THEORETICAL PERFORMANCE OF SOME LIQUID PROPELLANT SYSTEMS Second Quarterly Technical Summary Report
R. C. Oliver, S. E. Stephanou, R. J. Getz, D. Piper and R. W. Sprague
Jan. 20, 1963 268 p 10 refs
(Contract NOw-61-0905-c; ARPA Order 22-62)
(C-1960)

The theoretical performance of certain binary liquid-propellant systems under a wide variety of expansion conditions and mixture ratios has been computed and results are presented in graphical and tabular form. The graphs show vacuum specific impulse for area ratios of 8, 20, and 50, sea level optimum specific impulse, characteristic velocity, molecular weight and chamber temperature as a function of mixture ratio, for both frozen and equilibrium (shifting) expansion conditions, at chamber pressures of 300 and 1000 psi. The tabular data are in the form of computer output sheets, and give detailed performance and other data for all integral area ratios from 1 to 50; values are also given at two larger area ratios, the values depending on the system. Altitude effects are discussed, and techniques described for computing ideal performance for any of these mixtures at any altitude; results are given for sea level, 10,000 feet and 50,000 feet and vacuum as a function of area ratio for each mixture for zero divergence angle. The methods used in

carrying out the computations are described briefly, with reference to more detailed descriptions. The latest thermodynamic data are used, and a large number of minor species are considered for maximum precision. Author

27 PROPULSION

Includes: airbreathing, electric, liquid, nuclear, and solid propulsion.

For related information see: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N63-12507 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

ANALYSIS OF LIMITATIONS IMPOSED ON ONE-SPOOL TURBOJET-ENGINE DESIGNS BY TURBINES HAVING DOWNSTREAM STATORS AT 0, 2.0, AND 2.8 FLIGHT MACH NUMBERS

Richard H. Cavicchi and Anita B. Constantine Washington, NACA, Jan. 19, 1955 50 p 3 refs

(NACA RM E54J14) OTS: $4.60 ph, $1.70 mf (Declassified)

An aerodynamic design-point analysis was made of turbines with downstream stators to evaluate the potentiality of their use in turbojet engines designed for 0, 2.0, and 2.8 flight Mach numbers. Considered are turbines having both one and two rows of downstream stators, the flow-straightening action of which permits the use of high exit whirl without concomitant high exhaust-nozzle loss. Use of downstream stators results in moderate increase in capacities over conventional one-stage turbines; nevertheless, conventional conservative two-stage turbines have far greater capacities. Author

N63-12513 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

CASCADE INVESTIGATION OF COOLING CHARACTERISTICS OF A CAST-FINNED AIR-COOLED TURBINE BLADE FOR USE IN A TURBOPROP ENGINE

Francis S. Stepka, Hadley T. Richards, and Robert O. Hickel Washington, NACA, June 12, 1957 33 p 19 refs

(NACA RM E57D19) OTS: $3.60 ph, $1.19 mf (Declassified)

A small air-cooled turbine blade (1.4-in. span and 0.7-in. chord) intended for use in a cooled turboprop engine was investigated in a static cascade facility at combustion-gas temperatures of about 1060°, 1360°, and 1660° R. A method of correlating blade metal temperatures with dimensionless parameters is presented. The operating conditions of a typical turboprop engine are used in conjunction with the correlated data to estimate the blade cooling requirements when the turbine-inlet temperature of the engine is assumed to be 2460°R. Author

N63-12514 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

INVESTIGATION OF ROTATING-STALL LIMITS IN A SUPERSONIC TURBOFAN ENGINE

James F. Dugan, Jr. Washington, NACA, Oct. 3, 1957 27 p 13 refs

(NACA RM E57G26a) OTS: $2.60 ph, $1.01 mf (Declassified)

A theoretical mixed-jet one-spool turbofan engine was analyzed over a range of flight Mach numbers up to 2.95. Experimental tests were conducted on a rotor-blade row rigged to simulate turbofan first-stage operation. The variation of turbofan inlet flow coefficient with flight Mach number and the experimental results indicate that the turbofan flow would probably be free of rotating stall. Author

N63-12515 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

EFFECT OF PRESSURE LEVEL ON AFTERBURNER-WALL TEMPERATURES Thomas B. Shillito and George R. Smolak Washington, NACA, June 11, 1958 25 p 5 refs

(NACA RM E58D01) OTS: $2.60 ph, $0.95 mf (Declassified)

Afterburner-outlet pressures from 3700 to 6500 pounds per square foot absolute were investigated. Increases in afterburner-wall temperature with increasing pressure were due to the increasing local gas temperatures near the wall. There was no evidence of significant luminous radiation. For one condition investigated, however, heat transfer by nonluminous radiation from carbon dioxide and water vapor was equal in magnitude to convective heat transfer. Author

N63-12517 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

OFF-DESIGN PERFORMANCE OF DIVERGENT EJECTORS

Milton A. Beheim Washington, NACA, Sept. 30, 1958 62 p 4 refs

(NACA RM E58G10a) OTS: $6.60 ph, $2.06 mf (Declassified)

Fixed- and variable-geometry ejectors designed for turbojet operation at Mach 3 were investigated in the Mach number range 0.8 to 2. The performance of a fixed-geometry ejector with high secondary-flow rates was competitive with that of more complex variable-geometry ejectors. Variable-geometry ejectors with compromises to reduce mechanical complexity produced performance reasonably close to that for an ideal variable ejector. Author

N63-12521 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, Va.

THE DESIGN AND CASCADE TESTS OF FREE-STREAMLINE AND FULL-CONTOUR 160° TURNING SUPERSONIC-TURBINE-BLADE SECTIONS

Willard R. Westphal Washington, NACA, Aug. 16, 1957 24 p 1 ref

(NACA RM L57F21) OTS: $2.60 ph, $0.92 mf (Declassified)

The flow characteristics of two supersonic-impulse-turbine-blade sections designed for a turning angle of 160° have been studied. One section was of the full-contour vortex-flow type having a convex-surface design Mach number equal to the entering Mach number of 1.57 and a concave-surface design Mach number of 0.8. The other section had the same concave surface, but a large part of the convex surface was cut away, and a free streamline was left as the boundary of the flow in the passage. Author

N63-12524 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

AN ANALYSIS OF AIR-TURBOROCKET ENGINE PERFORMANCE INCLUDING EFFECTS OF COMPONENT CHANGES

Roger W. Luidens and Richard J. Weber Washington, NACA, Apr. 6, 1956 98 p 13 refs

(NACA RM E55H04a) OTS: $8.60 ph, $3.14 mf (Declassified)

An analytical study of the air-turborocket engine is presented, showing both full-power operation over a range of flight speeds and part-power operation at several supersonic speeds. Engine weight, drag and area variations are calculated in addition to the internal thrust coefficient and specific impulse. The effects of changes in the component designs and efficiencies are indicated. Maximum specific impulse (including nacelle drag and using gasoline-nitric acid propellants) at Mach 2.3 is 1500 lb/(lb/sec). The performance is compared with that of a typical turbojet engine. Author

N63-12528 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

PERFORMANCE OF A SINGLE FUEL-VAPORIZING COMBUSTOR WITH SIX INJECTORS ADAPTED FOR GASEOUS HYDROGEN

Jerrold D. Wear and Arthur L. Smith Washington, NACA, Nov. 30, 1959 23 p 4 refs

(NACA RM E55I14) OTS: $2.60 ph, $0.89 mf (Declassified)

The combustor was operated over a range of inlet-air pressures from 5.3 to 24.0 inches of mercury absolute and inlet-air reference velocities from 60 to 100 feet per second. The combustion efficiencies obtained with the six configurations varied from about 65 to 95 percent for a combustor temperature-rise range of 200° to 1400° F. At a temperature rise of 1200° F (near-rated engine conditions), the spread in efficiencies of the six configurations was about 5 percent. Efficiencies in the range of 65 to 85 percent were obtained at operating conditions beyond the burning range of conventional jet fuels. Author

N63-12529 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

PERFORMANCE OF A SHORT TURBULENT COMBUSTOR WITH HYDROGEN FUEL IN A QUARTER-ANNULUS DUCT AND COMPARISON WITH PERFORMANCE IN A FULL-SCALE ENGINE

Robert Friedman, Carl T. Norgren, and Robert E. Jones Washington, NACA, July 2, 1956 36 p 11 refs

(NACA RM E56D16) OTS: $3.60 ph, $1.28 (Declassified)

Satisfactory combustion efficiencies and outlet radial-temperature distributions at low total-pressure loss were obtained in an experimental, quarter-annulus combustor with hydrogen fuel at total pressures as low as 5.7 inches of mercury absolute. The combustor was 25 percent shorter than previous models for liquid hydrocarbon fuels. Similar performance was obtained from this combustor design operated with hydrogen in a full-scale engine. Author

N63-12530 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

ALTITUDE INVESTIGATION OF CAN-TYPE FLAME HOLDER IN 20-INCH-DIAMETER RAM-JET COMBUSTOR

George R. Smolak and Carl B. Wentworth Washington, NACA, June 3, 1954 28 p 5 refs

(NACA RM E54D08) OTS: $2.60 ph, $1.04 mf (Declassified)

An investigation of a can-type flame holder employing a fuel-air-mixture control sleeve in a 20-inch-diameter ramjet combustor was conducted at a simulated flight Mach number of 3.0 and altitudes from about 70,000 to 80,000 feet. The can-type combustor had peak combustor efficiencies of about 0.90 at fuel-air ratios of 0.018 and 0.04. The lower combustor efficiencies between these two fuel-air ratios were further reduced by reducing combustor-inlet pressure. Comparison with a previously reported circular V-gutter configuration revealed only slight differences in specific fuel consumption. Reduction of the 86-inch combustion-chamber length to 56 inches lowered the combustor efficiency 14 percentage points at a fuel-air ratio of 0.02 and 18 percentage points at a fuel-air ratio of 0.04. Author

N63-12531 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

COMBINED COMPRESSOR COOLANT INJECTION AND AFTERBURNING FOR TURBOJET THRUST AUGMENTATION

James W. Useller, S. C. Huntley, and David B. Fenn Washington, NACA, Sept. 16, 1954 35 p 21 refs

(NACA RM E54G08) OTS: $3.60 ph, $1.25 mf (Declassified)

Efficient, compatible performance can be obtained only by proper selection of a coolant suited to flight operating conditions, uniform introduction of the coolant into the compressor at the most advantageous location, minimization of any tendency toward reduction in compressor performance, as well as proper consideration to influence of the coolant on afterburning performance. An analysis based on the experimental results extended to flight Mach number 2.5 at 35,000-foot altitude shows an increase in augmented net-thrust ratio from 4.4 to 6.9 at stoichiometric afterburning by combining the stoichiometric afterburning with compressor coolant injection at an ammonia-air ratio of 0.04. Author

N63-12536 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

ROCKET ENGINE STARTING WITH MIXED OXIDES OF NITROGEN AND LIQUID AMMONIA BY FLOW-LINE ADDITIVES

George R. Kinney, Jack C. Humphrey, and Glen Hennings Washington, NACA, Aug. 19, 1953 32 p 11 refs

(NACA RM E53F05) OTS: $3.60 ph, $1.16 mf (Declassified)

Starting characteristics of mixed oxides of nitrogen-ammonia rocket engines were investigated with additives in the ammonia flow line for ignition. The oxidant was 70 percent by weight N_2O_4 and 30 percent NO. Starting with lithium as an additive was satisfactory over a wide range of conditions. A 1000-pound-thrust engine at ambient temperature started under all conditions during a 25-run series, including oxidant-fuel weight ratios from 0.6 to 14, oxidant and fuel leads, and times to reach starting flows from 0.1 to 3 seconds. With propellants and engine at –85° F, 200-pound-thrust engines started at oxidant-fuel weight ratios from 1.1 to 4.4; operating flow and combustion pressure were reached in 0.25 second. Weights of lithium in ammonia were of the order of 0.05 to 0.15 percent. In additional experiments at –85° F, all of five attempts with calcium resulted in satisfactory starts; starting was unreliable in three attempts with magnesium. Author

N63-12538 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

CALCULATED PERFORMANCE OF A MERCURY-COMPRESSOR-JET POWERED AIRPLANE USING A NUCLEAR REACTOR AS AN ENERGY SOURCE

R. B. Doyle Washington, NACA, Sept. 21, 1951 17 p 4 refs

(NACA RM E51F14) OTS: $1.60 ph, $0.80 mf (Declassified)

An analysis was made at a flight Mach number of 1.5, an altitude of 45,000 feet, a turbine-inlet temperature of 1460° R, of a mercury compressor-jet powered airplane using a nuclear reactor as an energy source. The calculations covered a range of turbine-exhaust and turbine-inlet pressures and condenser-inlet Mach numbers. For a turbine-inlet pressure of 40 pounds per square inch absolute, a turbine-exhaust pressure of 14 pounds per square inch absolute, and a condenser-inlet Mach number of 0.23, the calculated airplane gross weight required to carry a 20,000-pound payload was 322,000 pounds and the reactor heat release per unit volume was 8.9 kilowatts per cubic inch. These do not represent optimum operating conditions. Author

N63-12540 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

LOW-TEMPERATURE CHEMICAL STARTING OF A 200-POUND-THRUST JP-4-NITRIC ACID ROCKET ENGINE USING A THREE-FLUID PROPELLANT VALVE

Glen Hennings and Gerald Morrell Washington, NACA, June 30, 1955 25 p 16 refs

(NACA RM E55E04) OTS: $2.60 ph, $0.95 mf (Declassified)

Studies in a 200-pound-thrust rocket engine showed that the JP-4 nitric acid system could be started at temperatures as low as –65° to –60° F with a hydrazine-water igniter fuel. A three-fluid control valve scheduled the transition from igniter fuel to JP-4. Limiting igniter-fuel compositions for starting at –60° F were 55 and 69 percent hydrazine. When the same technique was used with an organophosphorous igniter fuel (RF 208) and with a blend of 70 percent triethylamine and 30 percent o-toluidine, starts were obtained at –80° F. Author

N63-12544 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

COMPARISON OF INJECTORS WITH A 200-POUND-THRUST AMMONIA-OXYGEN ENGINE

Richard J. Priem and Bruce J. Clark Washington, NACA, Sept. 4, 1958 10 p 4 refs

(NACA RM E57H01) OTS: $1.10 ph, $0.80 mf (Declassified)

Characteristic exhaust velocity was measured for four injectors as a function of chamber length. Results show that parallel-sheet, like-on-like, and triplet injectors give about the same performance and that a parallel-jet injector has a much lower performance. The performance with ammonia-oxygen was nearly the same as with heptane-oxygen. Author

N63-12545 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

PRELIMINARY ANALYSIS OF THREE CYCLES FOR NUCLEAR PROPULSION OF AIRCRAFT

L. V. Humble, W. W. Wachtl, and R. B. Doyle Washington, NACA, Oct. 13, 1950 25 p 4 refs

(NACA RM E50H24) OTS: $2.60 ph, $0.95 mf (Declassified)

A preliminary study was made of the feasibility of three cycles for nuclear propulsion of aircraft: a direct-air turbojet, a binary liquid-metal turbojet, and a helium-compressor jet. All three cycles appeared feasible for flight at a Mach number of 0.9 and altitudes up to 50,000 feet; the liquid-metal cycle appeared feasible for flight at a Mach number of 1.5. The air and helium cycles resulted in heavier aircraft than did the liquid-metal cycle, particularly at a Mach number of 1.5. The relative advantage of the liquid-metal cycle became greater as the flight speed and altitude increased, and as the reactor wall temperature decreased. Author

N63-12640 National Aeronautics and Space Administration, Washington, D.C.

LUNAR LANDING PROPULSION CONSIDERATIONS

K. R. Stehling Feb. 1963 23 p 3 refs

(NASA TN D-1723) OTS: $0.75

The propellant must have high density impulse, low ignition lag, and storability in space. The overall propulsion system must have operational reliability, simplicity, low weight, and throttling capacity. The four propellant combinations are rated in order of burnout velocities: F_2/N_2H_4, F_2/H_2, N_2O_2/N_2H_4, and H_2/O_2. The OF_2-diborane combination has interesting possibilities for further research. Author

N63-12674 Frankford Arsenal. Pitman-Dunn Labs., Philadelphia, Pa.

PROPELLANT ACTUATED DEVICES Monthly Progress Report No. 85

Dec. 1962 59 p

An investigation of propellant actuated devices encompasses: (1) the design and development of specific devices, such as thrustors, catapults, and initiators; (2) propellants and structural materials; and (3) improvement in the performance of propellant actuated devices and the extension of their application. I.v.L.

N63-12691 National Advisory Committee for Aeronautics. Lewis Flight Propulsion Lab., Cleveland, Ohio

EXPERIMENTAL STUDY OF BALLISTIC-MISSILE BASE HEATING WITH OPERATING ROCKET

J. Cary Nettles Washington, NACA, Sept. 23, 1958 11 p 1 ref

(NACA-RM-E58G17) OTS: $1.60 ph, $0.80 mf (Declassified)

Temperature as high as 1200°F was measured in the base of a missile model because of ignition of burnable rocket gases. Measurements are reported for the flight Mach number range of 0.8 to 2.0 for oxygen-fuel ratios of 1.7 to 2.8 and various extensions of the rocket motor out of cylindrical base. It was found that combustibles that are dumped into the base by accessories seriously aggravate the base-burning temperature rise. Author

28 SPACE RADIATION

Includes: cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts.

For related information see: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N63-12468 California U., Berkeley

A STUDY OF IONOSPHERIC ABSORPTION PRODUCED BY SOLAR COSMIC RAYS

Robert Anthony Weir, Jr. [1962] 108 p 32 refs

(Contract AF 49(638)-873)

(AFOSR-418)

The absorption of cosmic radio noise in the lower ionosphere due to the arrival of solar cosmic rays has been calculated for several locations at the high magnetic latitudes. The calculation was made in three parts; the volume production rate of electrons from ionization, the equilibrium electron density resulting from the competition between production and recombination processes, and the absorption of electromagnetic radiation passing through the ionized region. The calculation was made for proton energy spectra in the form of power law as observed by balloon-borne detectors following large solar flares. The calculated absorption was compared with observations obtained by riometers (relative ionospheric opacity meter) at Point Barrow, Fort Yukon, College, and Farewell, Alaska. For the solar proton event of July 14, 1959, the calculated absorption based on balloon data does not agree in magnitude nor latitude variation with the observations obtained by the Alaskan riometers. The lack of agreement in absolute magnitude indicates that the atmospheric coefficients used in obtaining the equilibrium electron density are in error. In particular, the collisional detachment as well as electron attachment coefficients appear to require considerable revision. The lack of agreement in the latitude variation substantiates observations at rocket altitude which indicate that the power law energy spectrum flattens considerably at proton energies below 100 Mev. Author

N63-12653 Iowa State U., Iowa City

DYNAMICS, COMPOSITION AND ORIGIN OF THE GEOMAGNETICALLY-TRAPPED CORPUSCULAR RADIATION

James A. Van Allen Repr. from Trans. Intern. Astron. Union, v. XIB, 1962 p 99-136 92 refs Presented at the Eleventh General Assembly of International Astronomical Union, U. of California, Berkeley, Aug. 16, 1961

(NASA Contract NASw-17)

The dynamics of geomagnetically trapped particles are reviewed. The review of particle dynamics begins with the work of Störmer on on the motion of an isolated charged particle in a static magnetic field and progresses through the natural system of coordinates for geomagnetically trapped particles. Observations of the earth's trapped radiation are discussed as follows: the discovery of the radiation belts, the scope of the observational study of geomagnetically trapped radiation, and the geometric structure of the belts. The sources of trapped particles are discussed for both the inner- and outer-radiation belts. R.C.M.

N63-12795 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.

IMMEDIATE SOLAR-FREE EFFECTS Final Technical Report, 26 March 1961 to 26 November 1962

Daniel W. Swift and W. G. Rohrer Feb. 11, 1963 122 p 42 refs
(Contract AF 19(604)-8058; ARPA Order 6-61)
(RAD-TR-62-58; AFCRL-63-213)

Revised values of effective electron-collision frequency for radio propagation are presented. In addition, the electron density as a function of time and altitude has been computed for a model SID (sudden ionospheric disturbance), using an X-ray spectrum derived from rocket measurements made during a solar flare. Models of recombination rate, empirically determined and derived from laboratory measurements, were used. The propagation of very-low-frequency radio waves in a horizontally stratified anisotropic ionosphere is discussed. The coupling between propagation modes is discussed in terms of reflection from and penetration through the ionosphere. Sample numerical solutions are also presented. An exhaustive compilation of the data that are presently available on measurements of solar X-ray fluxes is presented. Correlations of solar X-rays with sunspot and coronal activity are drawn. The significance of these correlations is discussed. Theories of solar X-ray sources and of solar X-ray spectra are discussed. A description of an Avco riometer installation is presented. The problems encountered and methods of operation are given. Author

29 SPACE SCIENCES

Includes: space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories.

For space biology see: 16 Life Sciences.

For related information see: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N63-12453 Radio Corp. of America. Aerospace Communication and Controls Div., Burlington, Mass.

ERROR STUDY OF ORBITAL PREDICTIONS Final Report

J. Boddy and M. Grossberg Apr. 20, 1962 92 p 11 refs
(Contract AF 19(604)-8041)
(ESD-TDR-63-189)

This study analyzes the statistics of sensor data obtained from the observations of artificial satellites. The effect of these statistics on the estimation of the orbital elements has been evaluated. Several techniques for removal of the actual orbit from the observations to derive residuals have been investigated. The residuals have been obtained using both polynomial fitting, with and without autoregressive scheme. From the satellites considered, no consistency was apparent in the magnitude of the variances of the individual parameters. However, a consistency was noted in the skewness of the residual. Computer programs have been developed for the determination of the statistics of the orbital elements from observation data. The study shows that the variances of the orbital elements are functions of the variance of the observations, the time of observation and description of the motion of the satellite. Furthermore, the variance of any orbital elements is minimum if the sum of the variance of the observations at a given time is minimum for a specific computational procedure of the orbital element from observations. The behavior in the statistics of the orbital elements exhibits a consistency in the measure of skewness and excess. Since these quantities are normalized with respect to the standard deviations, it appears that a bias is introduced in the computation procedure. Thus, the problem of obtaining accurate position prediction of artificial satellites is one of interplay between the quality of observations and an analytical description of the motion of the satellite. How to trade these factors depends upon the time allowed for deriving the orbit from observations. Author

N63-12577 California U., Berkeley. Space Sciences Lab.

MOLECULAR SPECTROSCOPY OF PLANETARY ATMOSPHERES

D. G. Rea Dordrecht, Holland, D. Reidel Pub. Co. Repr. from Space Sci. Reviews, v. 1, 1962 p 159-196 80 refs
(NASA Grant NsG-101-61)

Clearly spectroscopy has already provided considerable insight into the nature of the planetary atmospheres. Several molecular constituents have been positively identified, and upper limits have been placed on the abundances of others which are of particular significance in devising planetary models. But, equally clearly, the inadequacy of the spectral data, due to low spectral and/or spatial resolution, renders deductions of abundances, temperatures, and pressures very uncertain. With sole exception of the Martian CO_2 abundance, knowledge of the concentrations of planetary atmospheric constituents is unsatisfactory, and all numbers given must be regarded as only crude estimates. This latter comment applies equally well to the derived temperatures and pressures. What is urgently needed is the development of a reasonably complete theory of line formation in planetary atmospheres. This, coupled with more detailed spectroscopic work, should produce numerical values of atmospheric parameters which can be used with assurance. Author

N63-12581 RAND Corp., Santa Monica, Calif.

SOLAR SYSTEM SCIENCE: 1961 LITERATURE SURVEY, PART III. BOOK NOTES: A SELECTED LIST

Donna Wilson Repr. from Icarus, v. 1, no. 3, Oct. 1962 p 286-295 40 refs
(NASA Contract NASr-21(04))

Included in this survey are annotated listings of books on solar system science published in 1961. I.v.L.

N63-12593 National Aeronautics and Space Adminsitration. Ames Research Center, Moffett Field, Calif.

A FLIGHT EVALUATION OF LUNAR LANDING TRAJECTORIES USING A JET VTOL TEST VEHICLE

L. Stewart Rolls and Fred J. Drinkwater III Washington, NASA, Feb. 1963 15 p 1 ref
(NASA TN D-1649) OTS: $0.50

The similarity of the lift and reaction-type controls in a jet-supported VTOL aircraft and a lunar landing craft made the X-14A aircraft useful for a preliminary study of problems associated with lunar landing trajectories. Flight paths investigated started at 1000 feet altitude and 1 mile from touchdown and required 1 to 2 minutes. The pilot could perform the mission easily when his field of view included both the prescribed touchdown point and the horizon. Author

N63-12594 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.

THE COLLAPSE PHASE OF EARLY SOLAR EVOLUTION

A. G. W. Cameron Washington, NASA, Jan. 1963 14 p 2 refs
(NASA TN D-1682) OTS: $0.50

That phase of the contraction of a star in which H_2 molecules are being dissociated and H and He atoms are being ionized is examined, and it is found that a stellar configuration must be unstable against dynamical collapse during this phase. Quantitative calculations have been made with polytropes of indices 1.5 and 3. The gravitational instability sets in for stars of one solar mass at a radius of about 100 A.U. and ceases at about ½ A.U. If a star is rotating, having conserved angular momentum during its collapse, then it should

flatten into a nebular disk without forming a central body in hydrostatic equilibrium. Some physical parameters of possible disks are given. Author

N63-12595 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.

THE ORIGIN OF ATMOSPHERIC XENON

A. G. W. Cameron Washington, NASA, Feb. 1963 7 p 7 refs (NASA TN D-1685) OTS: $0.50

Some of the differences in the isotopic composition of atmospheric and meteoritic xenon can be attributed to irradiation of solar xenon by neutrons during the deuterium burning phase of solar contraction, which was followed by accretion of the irradiated xenon into the atmosphere. This problem is examined here more carefully in view of a new measurement which has been made of the reaction rate for the capture of protons by deuterium. It is concluded that, apart from the xenon produced by the decay of extinct radioactivities, most of the atmospheric xenon was in the sun during the deuterium burning phase. Author

N63-12596 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A THEORETICAL STUDY OF THE TORQUES INDUCED BY A MAGNETIC FIELD ON ROTATING CYLINDERS AND SPINNING THIN-WALL CONES, CONE FRUSTUMS, AND GENERAL BODY OF REVOLUTION

G. Louis Smith Washington, GPO, 1962 17 p 7 refs (NASA TR R-129) GPO: $0.30

The electromagnetic field equations are applied to nonferromagnetic conducting thin-wall cylinders, cones, and cone frustums. The equations are then applied to the general thin-wall body of revolution slowly spinning in a homogeneous magnetic field, in order to calculate the induced eddy currents and resulting torques. The solutions to these cases have direct application in calculating the magnetic torques tending to damp the rotation of spinning and tumbling satellites. Author

N63-12633 Northrop Space Labs., Hawthorne, Calif.

ORBITAL SEGMENT MECHANICS Technical Memorandum

Geza S. Gedeon Feb. 1962 28 p 5 refs (NSL-62-13; ASG-TM-61-43R)

Orbital equations based on general initial conditions are presented. These equations are not dependent on the orbital eccentricity and contain no reference to the line of apsides, thus they can be regarded as an extension of the pioneering work of Lambert. Lambert's original equations are also rewritten in terms of a single power series valid for the full range of conic sections. Finally the solution to the inverse of this power series equation is approximated by a polynomial devised by Cecil Hastings. Such a "Lambertian Mechanics" as presented here is as suitable for selecting interception trajectories (satellite, moon, or planet) as "Keplerian Mechanics" is for determining the orbits of heavenly bodies. Author

N63-12641 Canterbury U., New Zealand

THE ANNUAL AND DIURNAL VARIATION OF METEOR RATES IN THE SOUTHERN HEMISPHERE Final Report [Feb. 1960 to Jan. 1961]

C. D. Ellyett and C. S. L. Keay May 4, 1962 69 p 24 refs (Contract AF 64(500)-6) (AFCRL-62-324)

The results are given of a continuous survey of meteor rates for the year from February, 1960 to January, 1961. The omni-directional radar equipment used for this survey operated at a frequency of 69.5 megacycles, and was located near Christchurch, New Zealand, in the southern hemisphere. Extensive measures were adopted to ensure constancy of the equipment parameters and the elimination of sensitivity variations due to external noise, both man-made and natural. Meteors were recorded down to a limiting radio magnitude of +9.1, while the most frequently observed meteors were of radio magnitude +6.2. Echo rates as high as 200 per hour were often obtained. In this survey it has been shown that reliable meteor rates can be obtained free from the influence of ionospheric effects. The dominating influence of the angle between the observing station and the apex of the earth's way is now definitely established. Author

N63-12686 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

Z-FUNCTION SOLUTIONS FOR THE MOTION AND HEATING DURING ATMOSPHERE ENTRY FROM EQUATORIAL ORBITS OF A ROTATING PLANET

Frederick W. Boltz Washington, NASA, Feb. 1963 195 p 15 refs (NASA TN D-1555) OTS: $3.00

The two-dimensional equations of motion for atmosphere entry have been transformed into a pair of first-order differential equations or a single second-order differential equation in generalized coordinates. The transformation is similar to that introduced by Chapman (NASA TR R-11) and is based on the assumption of an exponential atmosphere. However, no terms are deleted from the initial equations, and the solutions obtained for a ballistic or a roll-modulated lifting vehicle of arbitrary shape, size, and weight are valid for the entire atmosphere trajectory. A number of numerical machine-computed (IBM 704) solutions are tabulated for entries at circular and supercircular velocity into the atmospheres of Earth, Mars, and Venus from nearly equatorial orbits. Author

N63-12696 Northrop Corp. Northrop Space Labs., Hawthorne, Calif.

ORBITAL LAUNCH OPERATIONS. ESCAPE WINDOW ANALYSIS

Herbert Reich and Richard Wolpert Dec. 1962 79 p 6 refs (Contract NAS8-853) (NSL-62-57; ASG-TM-61-91)

The analysis of the gross aspects of the flight mechanics for lunar trajectories from orbital launch is presented. An attempt is made to define the launch requirements from an earth orbit, the geometrical relationships existing between an Orbital Launch Facility in earth orbit and the moon in its orbit, the departure trajectory sensitivity to energy and time requirements, the launch-on-time problem, and the orbital "escape window". Author

N63-12728 Douglas Aircraft Co., Inc., Santa Monica, Calif.

THE GEOLOGY OF THE MOON. A PARTIAL BIBLIOGRAPHY OF MEASUREMENTS AND OBSERVATIONS

D. L. Weide Dec. 1962 99 p 574 refs (SM-42582)

N63-12747 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.

ROLE OF TURBULENCE IN STAR FORMATION IN ELLIPTICAL GALAXIES

A. G. W. Cameron Repr. from Nature, v. 196, no. 4857, Dec. 1, 1962 p 881 4 refs

The author proposes that the energy source for intense radio emitters (largely giant elliptical galaxies) can be derived from the enhancement resulting from collective stellar formation. In this formation, the most massive stars would evolve to the Type II supernovae stage in a reasonably short period of time. It is assumed that the energies associated with gas in an elliptical galaxy are small compared with the magnetic energy. Consequently, the magnetic field must control the contraction of the gas to form stars and will prevent

fragmentation until a late stage in which conservation of angular momentum causes the formation of a disk. It is pointed out by G. R. Burbidge and D. E. Osterbrook that elliptical galaxies often contain highly turbulent gas at their centers, and the energy per unit mass of such gas greatly exceeds the probable associated magnetic energy. However, the author states that, even if turbulent energy dominates conditions in the gas in such galactic centers, there seems to be no necessity that turbulence must similarly dominate the gas in the rest of the galaxy. The energy input to the turbulence in the rest of the galaxy is much smaller than it is in the center. Also, because the gas is much thinner relative to the assumed magnetic field, such a magnetic field is likely to dominate the gas if its strength is 10^{-6} gauss or greater. Therefore the author does not believe that neglect of turbulent energy invalidates this proposed mechanism of collective star formation. B.J.C.

N63-12785 Geological Survey, Washington, D.C.
ENGINEER SPECIAL STUDY OF THE SURFACE OF THE MOON
Robert J. Hackman and Arnold C. Mason 1961 4 p
(*Its* Miscellaneous Geological Investigations Map I-351)

Charts are given representing a photogeologic analysis of lunar photographs. The approximate scale of 1:3,800,000 was used to show the principal physiographic divisions, the geologic features, and the lunar rays. A table of miscellaneous geologic investigations is included. R.C.M.

N63-12841 National Aeronautics and Space Administration, Washington, D. C.
SPACE RESEARCH IN THE PHYSICAL SCIENCES
John F. Clark *In* AIBS Bulletin, v. 12, no. 5, Oct. 1962 p 70-72
(See N63-12834 06-16)

The results of research in the physical sciences, using sounding rockets, satellites, and space probes, are reviewed. Information on the following is summarized: earth as a planet, earth-sun relationships, the moon and the planets, and astronomical data collected above the earth's atmosphere. M.P.G.

30 SPACE VEHICLES

Includes: launch vehicle—spacecraft combinations; operating problems; and stability and control.

For manned space capsules, satellites, and space probes see: 32 Space Vehicles (Spacecraft).

For boosters and rockets see: 31 Space Vehicles (Launch Vehicles).

For related information see: 04 Aircraft; 08 Communication; and 22 Navigation and Guidance.

N63-12450 Aerojet-General Corp., Sacramento, Calif.
HIGH AND LOW-TEMPERATURE TESTS OF THE AEROJET UTILITY VAN
Jack D. Sohl Dec. 19, 1962 49 p
(Contract AF 33(600)-36610)
(Rept. 0162-OITN-62-18; BSD-TDR-62-331)

The Aerojet-General utility van has successfully completed high- and low-temperature tests to verify the acceptability of the van as a transport vehicle for second-stage Minuteman operational motors. A Minuteman motor cast with propellant simulant was used in the tests. While the exterior of the van was subjected to high and low temperatures, ranging from +140° to -35° F, the surface of the motor was maintained within the specified temperature range of 80° ±20° F. Author

N63-12451 Aerojet-General Corp., Sacramento, Calif.
RESULTS AND ANALYSES OF AEROJET-GENERAL UTILITY VAN CERTIFICATION PROGRAM
K. H. Staacke and D. P. Campbell Dec. 1962 50 p
(Contract AF 33(600)-36610)
(Rept. 0162-OITN-62-19; BSD-TDR-62-329)

The Aerojet-General Utility van has successfully completed certification-test requirements to qualify as a transport vehicle for Minuteman second-stage operational motors. The Aerojet Utility van, while transporting live second-stage motors supported in an Aerojet universal harness, was subjected to a series of plank-strip-course and rough-road condition tests to produce sinusoidal inputs to accelerometer locations on the universal harness and motor. A comparative analysis of the acceleration-response data recorded during these tests with data recorded during the tests of four other van-harness combinations is presented. Author

N63-12683 Aeronautical Systems Div. Flight Control Lab., Wright-Patterson AFB, Ohio
CLOSED-LOOP STABILITY OF A WINGED PAYLOAD BOOSTER SUBJECT TO VARIATIONS OF AN ELASTIC MODE SHAPE [Interim Progress Report, Sept.-Nov. 1962]
Robert L. Swaim Nov. 1962 23 p 3 refs
(ASRMCM-TM-62-11)

Relatively small variations in first bending elastic mode shape can easily result in longitudinal forward-loop dynamic instabilities for a highly elastic, winged booster. The analysis herein is concerned with the effect of the variations in first bending mode shape on the stability of a booster with a simple rate and attitude feedback control system. It is found that the system stability is still sensitive to small mode shape variations when elastic and short-period frequencies are close, but not to as great an extent as was the forward-loop system alone. The elastic mode and closed-loop short-period frequencies are relatively insensitive to the mode shape variations. However, the damping of the two modes is quite sensitive. Author

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes: boosters; clustered rockets; and multistage rockets.

For propulsion engines see: 27 Propulsion.

For launch vehicle - spacecraft combinations see: 30 Space Vehicles.

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-12360 National Aeronautics and Space Administration, Washington, D. C.
THIRD SATURN ROCKET TO BE LAUNCHED News Release No. 62-237
Nov. 13, 1962 22 p

The Saturn SA-3 launch is described along with a description of the vehicle, the launch facility, and Project High Water. Background information on the Saturn C-1 Program is included. R.C.M.

N63-12491 National Aeronautics and Space Administration, Washington, D. C.

NASA SIMPLIFIES NAMES OF SATURN LAUNCH VEHICLES News Release No. 63-26

Feb. 7, 1963 3 p

Names of Saturn launch vehicles will be simplified, according to The National Aeronautics and Space Administration. Saturn C-1 will be called "Saturn I," the Saturn C-IB will be known as "Saturn IB," and the Saturn C-5 becomes "Saturn V." All three vehicles will be used in the Apollo Manned Lunar exploration program. The Saturn I will be used to place the command module of the Apollo spacecraft, bearing a three-man crew, into earth orbit for up to two weeks. The second vehicle, Saturn IB, will be capable of placing the complete Apollo spacecraft into earth orbit. It will be able to place 16 tons into earth orbit, compared to 10 tons for Saturn I. The largest of the three vehicles, the Saturn V, is the Apollo moon rocket for manned lunar landings. This rocket will be able to place about 120 tons into earth orbit and send 45 tons to the vicinity of the moon. B.J.C.

32 SPACE VEHICLES (SPACECRAFT)

Includes: manned space capsules; satellites; and space probes.

For boosters and rockets see: 31 Space Vehicles (Launch Vehicles).

For Launch vehicle—spacecraft combinations see: 30 Space Vehicles.

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-12359 National Aeronautics and Space Administration, Washington, D. C.

MARINER SPACECRAFT News Release No. 62-182

Aug. 15, 1962 48 p

The Mariner II spacecraft is described along with the experiments to be carried out during its flight. Preliminary experimental results and trajectory data are included. R.C.M.

N63-12361 National Aeronautics and Space Administration, Washington, D. C.

NASA TO LAUNCH RELAY EXPERIMENTAL SATELLITE News Release No. 62-258

Dec. 11, 1962 27 p

The objectives of Project Relay, the satellite's physical characteristics, and the television, telephone, and teletype experiments to be conducted from ground stations during orbit are described. Three experiments to test the hazards of radiation to a communications spacecraft are discussed: the Relay satellite's orbit will determine solar cell damage, diode damage, and will measure the amount of radiation to which the solar cell and diodes have been subjected. The Delta Launch Vehicle and the NASA test stations are described. A.R.B.

N63-12639 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE EXPLORER XVI MICROMETEROID SATELLITE DESCRIPTION AND PRELIMINARY RESULTS FOR THE PERIOD DECEMBER 16, 1962 THROUGH JANUARY 13, 1963

Earl C. Hastings, Jr., comp. Washington, NASA, Feb. 1963 31 p 3 refs

(NASA-TM-X-810)

The Explorer XVI (1962 Beta Chi 1, also designated the S-55B micrometeoroid satellite) carries pressurized cells that lose pressure when they are punctured, exposed wires and shielded grids that can become open circuits when damaged, shielded cadmium sulfide detectors that change conductivity when the shields are punctured and sunlight is admitted, and sounding boards. The outputs of variously shielded solar cells determine the degradation due to the space environment. Cell-puncture frequency for the first 4 weeks in orbit (December 16, 1962, through January 13, 1963) appears to fall between two previous estimates. Author

N63-12838 National Aeronautics and Space Administration, Washington, D. C.

MANNED SPACE FLIGHT

Brainerd Holmes *In* AIBS Bulletin, v. 12, no. 5, Oct. 1962 p 56-59 (See N63-12834 06-16)

The NASA Manned Space Flight programs to accomplish a manned lunar landing are described, and the expected problem areas are discussed. Based on the performance of astronauts to date, evidence is presented that there is no substitute for man's judgment and curiosity in novel and unexpected situations. The four major manned space programs described are: (1) the Mercury program, which is in its final stages; (2) the One-Day Missions program, which will extend the time of weightlessness and allow further assessment of its physiological effects; (3) the Gemini program, which will extend capability to two men for 10 days with the aim of developing rendezvous techniques and studying prolonged weightlessness effects; and (4) the Apollo program, whose aim is to land men on the moon and return them to earth. The difficulties of developing hardware, integrating subsystems, coordinating far-flung logistics, and assessing the complex system reliabilities and capabilities are considered. M.P.G.

33 STRESSES AND LOADS

Includes: fatigue; vibration; flutter; and structural tests.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; and 34 Structural Design.

N63-12403 Japan. Ministry of Transportation. Transportation Technical Research Inst., Tokyo

ON THE STRENGTH OF THE ORTHOGONALLY STIFFENED PLATE. (1ST REPORT: THEORETICAL SOLUTION OF ORTHOTROPIC PLATE SUBJECTED TO BENDING)

Noritaka Ando Mar. 1962 63 p 54 refs

(TTRI-48)

To analyze the bending strength of orthogonally stiffened plates, theoretical solutions of orthotropic plates with various boundary conditions and transverse loadings are obtained. The results are then applied to the analysis and design of ship structure. A series of tests with large-scale models is carried out to verify the validity of applying the results obtained, using the theory of orthotropic plates, to the orthogonal structure of a ship. B.J.C.

N63-12404 Japan. Ministry of Transportation. Transportation Technical Research Inst., Tokyo

ON THE STRENGTH OF THE ORTHOGONALLY STIFFENED PLATE. (2ND REPORT: EXPERIMENTAL STUDIES ON BENDING OF ORTHOGONALLY STIFFENED PLATE AND COMPARISON WITH THE BENDING THEORY OF ORTHOTROPIC PLATE)

Noritaka Ando Nov. 1962 45 p 54 refs

Analysis of orthogonally stiffened plates by the orthotropic plate theory was investigated so as to determine whether this theory could be used in the analysis and design of ship structure. The following conclusions were reached: (1) Deflection or stress of orthogonally stiffened plates with various boundary conditions and loadings is sufficiently represented by corresponding formulas based on the orthotropic plate theory. (2) For the bending rigidity in the theoretical calculation, Ei (E = Young's modulus of material, i = moment of inertia of section per unit breadth) may be adopted. Good results may be expected in calculating i, if the overall mean stiffness is adopted in the case of deflection, and one pitch mean stiffness is adopted in the case of stress. (3) For the torsional rigidity, the torsional coefficient presented by Schade may be used. (4) When the moment of inertia or the section modulus of the stiffener is estimated, the effective breadth of the plate must be considered by using one full pitch breadth for effective breadth. (5) If some stiffeners have considerably large stiffness compared to others, the deflection or stress of the actual structure will not agree with the value derived from the homogeneous orthotropic theory because of the local effect. I.v.L.

N63-12427 North American Aviation, Inc. Space and Information Systems Div., Downey, Calif.

ROOM TEMPERATURE CURING ADHESIVES FOR SATURN S-II. PART I—SCREENING PROGRAM Interim Report

John J. Whelton Mar. 5, 1962 67 p (SDL-324)

Since this was a limited program, testing was confined to lap-shear and flatwise tensile tests only. Lap-shear tests were conducted at 160°, 78°, -320°, and, -423° F. Selected adhesives were also tested for lap-shear strength after 30 days, at 96 percent relative humidity, and 120° F. These tests were run at 160° F, 78° F, and -423° F. Flatwise tensile tests were conducted at 160° F and -423° F. Initially, this program was aimed at a room temperature cure under contact pressure. The results obtained with this cure indicated that it was insufficient to produce the degree of polymerization needed to ensure proper strength in the adhesive and the proper degree of reliability of the bond needed for this application. Because of this, the cure was changed to 16 hours at 120° F under vacuum pressure, and all conclusions drawn from this project were taken from data obtained with this latter cure. Results of the tests indicated that no difficulty would be encountered at the low end of the test temperature range and that strength at temperatures in excess of room temperature would be more difficult to obtain with the limiting cure cycle available. Of the 18 adhesives investigated, only those bearing code numbers 102, 103, 201, 401, and 902 were selected for subsequent evaluation in Phase II studies. Author

N63-12452 Aerojet-General Corp., Sacramento, Calif.

STRUCTURAL VERIFICATION TESTS OF THE AEROJET UTILITY VAN

W. D. Hulse Dec. 1962 98 p

(Contract AF 33(600)-36610)

(Rept. 0162-OITN-62-20; BSD-TDR-62-330)

Structural tests to verify the acceptability of the Aerojet-General Utility van as a transport vehicle for second-stage Minuteman operational motors have been successfully completed. During the tests, the van and tie-downs were subjected to limit loads to determine stress levels at critical load points and to measure vehicle deflection and recovery from the downward and side loads imposed. Author

N63-12460 Illinois U., Urbana

INTERACTION OF PLANE ELASTIC WAVES WITH AN ELASTIC CYLINDRICAL SHELL Technical Report

T. Yoshihara, A. R. Robinson, and J. L. Merritt Jan. 1963 136 p

(Contract Nonr-1834(03))

(Structural Research Series No. 261)

The purpose of this study was to investigate the interaction of plane elastic waves with a thin, hollow, cylindrical shell embedded in an elastic medium. The cylindrical shell is considered to be elastic, isotropic, homogeneous, and of infinite length. It is surrounded by an elastic, isotropic, and homogeneous medium whose motions conform to the ordinary theory of elasticity. A plane stress wave, either dilatational or shear, with a step variation in time, whose wave front travels in a direction perpendicular to the cylinder axis, envelops the shell. Later, a Duhamel integral is used to study other wave shapes for the incident stress. The equations to be solved consist of two pairs of coupled integrodifferential equations in the generalized coordinates of the shell and the displacement potentials. Numerical solutions are obtained to determine the effect of the several parameters which describe the relative physical properties of the shell and medium. Author

N63-12479 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

EXPERIMENTAL EVALUATION OF THEORETICAL ELASTIC STRESS DISTRIBUTIONS FOR CYLINDER-TO-HEMISPHERE AND CONE-TO-SPHERE JUNCTIONS IN PRESSURIZED SHELL STRUCTURES

William C. Morgan and Peter T. Bizon Washington, NASA, Feb. 1963 28 p 8 refs

(NASA TN D-1565) OTS: $0.75

An experimental investigation was made of the stress state that exists in a toriconical structure of constant wall thickness. The data were compared with stress states determined analytically by methods published in a previous phase of the same general program. The results of the investigation proved the validity of the analyses. Correlation was within reasonable limits of experimental error. Author

N63-12484 France. Office National d'Études et de Recherches Aéronautiques, Chatillon-sous-Bagneux

VIBRATIONS DE RESPIRATION DES CYLINDRES MINCES, HOMOGÉNES OU NON (BREATHING VIBRATIONS IN HOMOGENEOUS OR NON-HOMOGENEOUS THIN CYLINDRICAL SHELLS)

Gabriel Coupry (Thesis— Paris U.) [1962] 9 p 4 refs In French; English summary

The theory of vibrations in homogeneous thin cylindrical shells developed some years ago makes mandatory, for its application, the utilization of powerful computers. This paper gives simplified formulas applicable, in most cases, for determining with only a slide rule the vibratory characteristics of thin cylinders. The method has been extended to the study of thin elastic cylinders provided with viscoelastic coatings on their inner wall. Measurements have permitted checking the practical interest of the method suggested. Author

N63-12493 General Electric Co. Flight Propulsion Lab. Dept., Cincinnati, Ohio

HIGH-TEMPERATURE MATERIALS PROGRAM Progress Report No. 19, Part A [Oct. 15, 1962 - Dec. 15, 1962]

Jan. 25, 1963 46 p 16 refs

(Contract AT(40-1)-2847)

(GEMP-19A) OTS: $1.25

Fabrication of high-temperature reactor materials was investigated. In stress-rupture tests, identical results were obtained at 2200°C in both hydrogen and argon for two (Mo-B, 0.011 inch thick and Mo-C, 0.015 inch thick) of the three different heats of molybdenum

employed. The third heat (Mo-A, 0.01 inch thick) exhibited much longer rupture life, particularly at a stress level of 1000 psi. The stress-rupture properties of tantalum were evaluated in two grades of argon and two grades of hydrogen. The stress-rupture life in argon was found to decrease as the dewpoint was decreased. Tungsten contamination was found on the surface of tantalum samples tested in the "wet" argon. This observation stresses the importance of employing extremely low (about –75° C) dewpoints in stress-rupture tests in noble gas atmospheres at elevated temperatures (2000° C). No significant difference was noted in the tantalum stress-rupture life test data obtained for tests conducted in commercial (2000 ppm impurities) and high grade hydrogen (5 ppm impurities). Effects of radiation on high-temperature alloys was investigated. All tensile data obtained for A-286 alloy, Hastelloy X, and Rene' 41 are reported. The effects of radiation on the stress-rupture of overaged and underaged specimens of Rene' 41 are presented. I.v.L.

N63-12500 National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.
FLUTTER TESTS OF SANDWICH-TYPE FLAT PANELS AT MACH NUMBERS OF 2.97 AND 4.12
Eldon E. Kordes and Ernest W. Evans Washington, NASA, Dec. 1958 17 p 2 refs
(NASA-MEMO 10-17-58L) OTS: $1.60 ph, $0.80 mf (Declassified)

Tests were made to determine the stability of sandwich-type flat panels exposed to flow over one surface. Two configurations, one a honeycomb-sandwich panel and the other a corrugated stiffened panel, were tested in a supersonic blowdown jet. The panels were supported by lightly clamping the edges in such a way that thermal expansion was allowed. No panel flutter was observed during the tests; however, one corrugated panel, which had survived several previous tests, was destroyed during a tunnel starting period. This failure, which occurred near the supported edges, was believed to have been caused by fatigue. Author

N63-12582 Brown U., Providence, R. I.
LINEARIZATION IN PROBLEMS OF FINITE PLASTIC FLOW
Manohar Singh Jan. 1963 36 p 10 refs
(Contract Nonr-562(10))
(C11-85)

Various methods of linearizing yield condition and flow rule are discussed in connection with problems in finite plastic strains (drawing of tubes, nosing of shells). The numerical results presented in this paper show that, when carefully handled, some of these methods give excellent approximations to the predictions of von Mises theory, which will usually involve more elaborate analysis. Author

N63-12590 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE IN-PLANE VIBRATIONS OF A FLAT SPINNING DISK
James G. Simmonds Washington, NASA, Dec. 1962 41 p 4 refs
(NASA TN D-521) OTS:$1.00

An analysis of the influence of spinning on the natural frequencies of vibration of a thin elastic disk is first made, and it is shown that this influence is negligible. Next, the natural frequencies for a stationary disk corresponding to the two extreme cases of clamping to a rigid hub and no clamping whatsoever are calculated. Approximate expressions for the two natural frequencies of a clamped disk which approach zero as the ratio of hub diameter to disk diameter approaches zero are given. Finally, there is presented an orthogonality relation between any two natural modes of vibration. Author

N63-12679 Aberdeen Proving Ground. Ballistic Research Labs., Md.
DETERMINATION OF VISCOELASTIC MODEL CONSTANTS FROM DYNAMIC MECHANICAL PROPERTIES OF LINEAR VISCOELASTIC MATERIALS
W. Goldberg and N. W. Dean Nov. 1962 40 p 13 refs
(BRL-1180)

A semianalytical method of determining the generalized Voigt model which represents the dynamic mechanical properties of a linear viscoelastic material over a range of frequencies of three decades is presented. This model representation is shown to be equivalent to the differential operator formulation of the linear viscoelastic stress-strain law. The method is applied to complex creep compliance data for N.B.S. polyisobutylene at 22 different temperatures. In general, the compliances calculated from the models differ from the experimental data by less than 5%. Author

N63-12774 Aeronautical Research Labs., Melbourne (Australia)
FLEXIBILITY MATRICES FOR ELEMENTS OF CONSTANT AND VARIABLE CROSS-SECTIONS UNDER GENERAL LOADING
L. J. Schmid Apr. 1961 48 p 3 refs
(ARL/SM-279)

A routine method for generating the flexibility matrices for elements of generalized cross-sectional and stress-resultant variations is developed. Then the method is applied to some particular cases of beams of variable moment of inertia subjected to distributed loads. Author

N63-12807 Aeronautical Research Labs., Melbourne (Australia)
TYRE IMPACT TESTS ON AIRPORT TAXIWAY LIGHTS
F. H. Hooke and S. R. Perry July 1961 16 p
(ARL-SM-103)

In order to obtain information which could be used to assess the impact loads between aircraft wheels and taxiway lights of different design during the taxying of aircraft, the accelerations of a wheel of a motor vehicle passing over wooden replicas of, and actual, taxiway lights were measured. The results showed that the measured impact acceleration was roughly proportional to the volume of the light fixture protruding from the runway surface. Lower impacts were recorded with a light of another design having a lens of smaller volume. Author

34 STRUCTURAL DESIGN

Includes: structural elements; and weight analysis.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; and 33 Stresses and Loads.

N63-12355 Northrop Space Labs., Hawthorne, Calif.
A VARIABLE GEOMETRY SPACE STRUCTURES CONCEPT. BASIC CHARACTERISTICS AND CAPABILITIES
W. R. Hilker and R. S. Fujioka Oct. 1962 40 p
(NASA Contract NASr-114)
(NSL-62-228) OTS: $3.60 ph, $1.40 mf

This report summarizes the results of exploratory investigations into a variable-geometry space-structures concept based on ring supported, interlaced arch principles. Investigations into the geometric and structural variations possible within the concept have resulted in several observations and conclusions. First, the concept can be successfully adapted to provide a range of extension modes without sacrifice to its inherent self-positioning characteristics. Second, several framework enclosure concepts appear feasible. Accordion-folded fabrics and pneumatic semirigid systems are particularly adaptable to certain framework variations. Hinged, rigid panel enclosure techniques can also be successfully integrated with the concept. This

ability is particularly valuable from the standpoint of meteoroid and radiation hazard protection. Pressure-tight capability, however, appears possible only in the folded or completely extended forms. Author

N63-12656 Astro Research Corp., Santa Barbara, Calif.
ON ISOMETRIC DEFORMATION OF SCREW SURFACES
G. M. Schindler Aug. 29, 1962 14 p 3 refs
(NASA Contract NASr-8)
(ARC-R-72) OTS: $1.60 ph, $0.80 mf

A study of strain-free deformation mechanisms of surfaces that are capable of folding into a flat annular disk of vanishing engulfed volume is presented. The approach used follows a technique of isometric mapping. Author

N63-12661 Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
STRUCTURAL INTEGRITY OF SHIPPING CONTAINERS FOR RADIOACTIVE MATERIALS. PART I: STUDY OF TRANSPORT OPERATIONS AND CONTAINER CONSTRUCTION
H. G. Clarke, Jr., and M. M. Reddi AEC Div. of Tech. Information, July 1962 149 p 872 refs
(Contract AT(30-1)-2539)
(NYO-9859) OTS: $2.75

The development of quantitative methods for assessing the structural integrity of shipping containers for radioactive materials during both normal transportation operations and accidents was investigated through the following studies: (1) accident situations, as well as shock and vibration during normal operations in rail and highway transport, (2) construction features and design reports of existing containers, (3) data on dynamic properties of materials, and (4) analytical or experimental methods that might be adapted to determining large inelastic deformation in dynamically loaded structures. I.v.L.

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